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The AMPICO
Reproducing Piano

INSPECTORS'
INSTRUCTION BOOK
1919

WITH 1920 SUPPLEMENT

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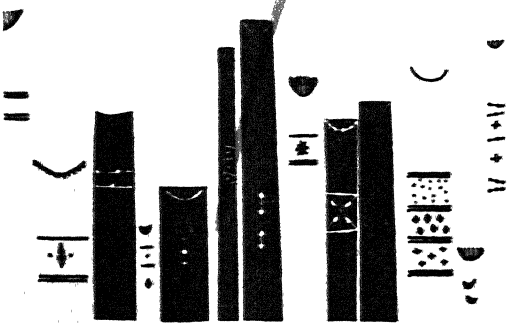
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FOREWORD

THE explanations in this book are for the purpose of giving the inspector a thorough understanding of the working principles of the Ampico. Most of the illustrations are made from sectional drawings in order to show the internal arrangement of the channels, valves, etc.

The first part of the book explains how the various mechanisms of the Ampico work; how adjustments are made; and how trouble is located and repaired. The second part gives a very thorough method of inspecting an Ampico to determine if it is in perfect condition, or in need of adjustment or repair.

This instruction book thoroughly explains the various mechanisms which are peculiar to the Ampico but does not go into the pneumatics and other parts which are found in all players, as the repairman is, of course, familiar with these.

All the explanations are based on the upright Ampico, but apply equally well to the grand, as both work on the same principle.



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THE AMPICO reproduces the playing of a pianist just as the talking machine reproduces the playing of a violinist, excepting that the Ampico actually plays the piano, while the talking machine instead of playing the violin produces a sound like unto that of the violin. One is the actual playing of the instrument, while the other is an imitation of the music of the instrument.

In order to reproduce an artist's playing it is necessary to take a record of it which will show all the various characteristics.

The sheet upon which the record is taken moves at an even speed and little pencils mark down the notes as they are played. Likewise the pedals are recorded. By a secret process the loudness with which each note is struck is recorded as is the length of time each string of the piano vibrates audibly. The accents and various loud and soft effects are recorded by this latter process as are the tonal effects which are so important to beautiful piano playing.

"Dynamics" in piano playing means the power of the blow. As a pianist strikes all powers of blow from the softest to the loudest, it is necessary for the reproduction piano, which is to *exactly reproduce,* to do the same.

An accent is a clearly defined increase in the power of the blow.

A crescendo is a gradual and usually smooth increase in power.

A decrescendo or diminuendo is gradual decrease in power.

A nuance is a gentle shading in expression. The word may be applied to tone coloring, but usually signifies a very slight and finely graded crescendo.

It has been found by experimentation that the ear can distinguish about six different degrees of accents when the playing is soft, and naturally less as the playing grows louder.

The Ampico System of Dynamic Control provides seven steps of loudness. By means of side perforations in the music roll the intensity of the playing can be set to any of these seven steps and remains so set until a subsequent perforation, or combination of perforations, sets it to another step. The change in intensity takes place practically instantaneously. By quick changes in intensity settings, melody notes or accented notes can be brought out without affecting the loudness of the surrounding notes.

It has also been found experimentally that no number of steps will produce a smooth crescendo effect; to say nothing of nuance effects. When the Ampico first appeared it had only sixteen steps to work with to produce dynamic effects, but these were soon found to be entirely nadequate to give smooth crescendo or nuance effects so the mechanism was redesigned to enable it to produce crescendo effects.

It was then found that sixteen steps of loudness were unnecessary to produce accents and so these were cut down to seven. Fig. 1 shows the difference between the ways the imperfect jerky crescendo was got in the the old original Ampico, and the smooth crescendo in the present perfected instrument. (All of the original instruments were exchanged for the present type, free of charge.)

The effect of using the steps and the crescendo at the same time is very wonderful. It makes it possible for perfectly smooth crescendos to be played at the same time as clearly defined accents are being given. (See Fig. 2.)

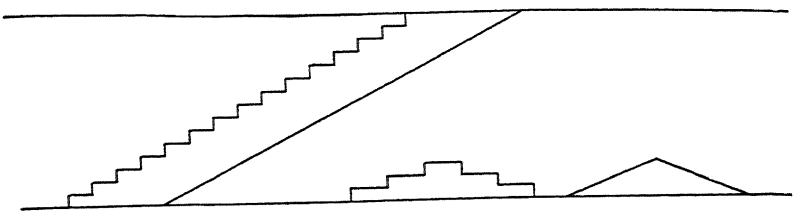


Fig. 1

The flight of steps connecting the bass line with the top line of the diagram represents the method of producing a full crescendo effect in the original Ampico. The oblique straight line to the right of the steps represents the present method of producing a full crescendo. The old method was found to be perceptibly jerky, while the new method is perfectly smooth.

To the right of the full crescendo is shown the old method of producing a nuance effect, and the little pyramid at the right represents the present perfectly smooth method. It is easy to imagine how jerky a nuance produced by steps might sound when one thinks of this nuance as being in a trill and only increasing in loudness to the third step in the scale of sixteen. The trill might have thirty-two notes in it, and instead of smoothly growing louder and softer it would contain three abrupt step-ups and three abrupt step-downs.

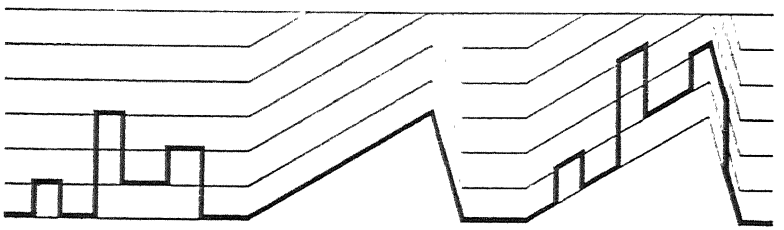


Fig. 2

The seven light lines in this figure represent the seven steps of intensities. The heavy dark line represents the loudness of the playing. Starting from the left side and traveling toward the right it will be noticed that the playing starts at No. 1 intensity, then steps up to No. 2, and then back to No. 1. Two more step-ups take place and then a slow crescendo without steps which carries the No. 1 intensity up to the loudness of the normal No. 4 intensity. This slow crescendo is followed by a speed decrescendo which quickly carries the loudness of the No. 1 intensity back to its normal position. The last part of the diagram shows the same crescendo repeated, but with the step-ups the same as in the first part of the diagram taking place simultaneously.

It will be noticed that when a crescendo takes place the loudness of all of the intensities gradually rises, making what has been termed a floating scale of intensities. The No. 6 intensity very quickly becomes as loud as the No. 7, and as there is no intensity higher than No. 7 it merges into it. Shortly after it will be noticed the No. 5 merges into the No. 7.

It might be imagined that this diagram represents a small portion of a music roll. Perhaps two or three accompaniment notes are first struck with No. 1 intensity, then a slightly accented bass note of the accompaniment is struck with No. 2 intensity, followed by two or three notes on No. 1 intensity, then the first melody note strikes on No. 4 intensity, followed by other melody notes at No. 2 intensity, and No. 3 intensity, then the loudness drops to No. 1 intensity for some accompaniment notes. Although the melody will have been brought out in this portion of the piece, and the bass notes of the accompaniment struck with slightly increased pressure there will be no crescendo effect.

It will not be hard to see how different this same portion of the piece would sound if in the accompaniment and the melody there were an effect of everything gradually growing louder, and then almost suddenly coming back to normal as shown in the right-hand portion of the diagram.

THE AMPICO SYSTEM OF DYNAMIC CONTROL

THE FUNCTION of the Dynamic Mechanism is to control the loudness of the playing. The Ampico system of Dynamic Control makes it possible to get sudden changes of loudness or gradual fluctuations, which latter in musical terms are called crescendos or diminuendos.

Seven degrees or intensities of loudness are used to produce accent and sudden stepping-up effects, while the spring pneumatic mechanism makes it possible to smoothly increase the power of the playing from the softest to the loudest at any speed required. Both of these mechanisms can work simultaneously and produce accent or step effects during a crescendo effect.

The regulator valve is secured to the regulator valve stem which is in turn fastened to the lever arm. Three little intensity pneumatics fastened to the under side of the lever arm are fed by regulated air, the same as goes to the striking pneumatics; while the spring pneumatic, which is fastened to the upper side of the lever arm, is fed with air from a regulator pneumatic controlling the softest intensity. This pneumatic functions during crescendo effects and is therefore conveniently called the "crescendo pneumatic." This "crescendo pneumatic" in turn gets its supply, through a constricted channel, from a little regulating valve. The rubber tube leading from the top of the little regulating valve is a muffler tube.

The three little pneumatics pull down on the lever arm and tend to close the regulator valve while the spring pneumatic pulls up and tends to open it. When there is no crescendo taking place the up-pull of the spring pneumatic is constant and even. When a crescendo is taking place the up-pull of this pneumatic gradually increases.

The Dynamic Mechanism not only controls changes in the loudness of the playing but it has the very important function of maintaining even tension on the regulated air regardless of whether few or many notes are being played.

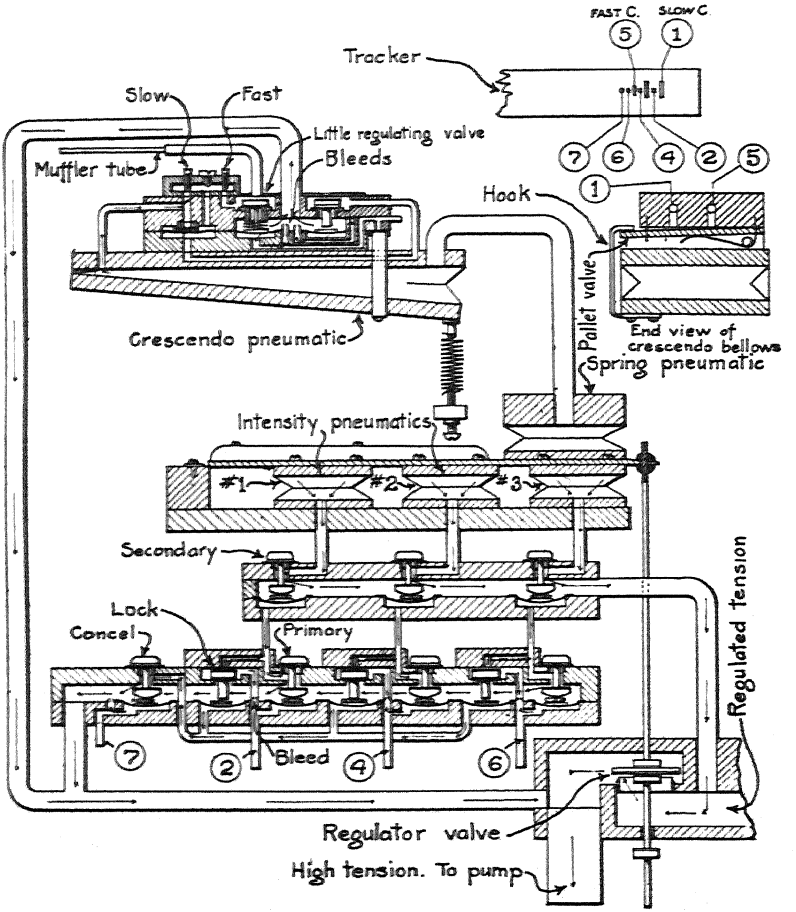


Diagram of Dynamic Mechanism

If no notes are being played the regulator supplies just enough air to make up for leakage. When a note is played it causes the tension in the wind chest to drop slightly and as it is this same air which supplies the three little intensity pneumatics, their down-pull on the regulator valve is lessened and the valve opens slightly, thereby letting more air pass through it, but only enough to increase the down-pull of the intensity pneumatics to a point where it just equals the up-pull of the spring pneumatic. The regulator is so sensitive that it will correct a drop in the tension which is imperceptible in the playing and barely noticeable on a water gauge.

If atmosphere is admitted to one of the intensity pneumatics the down-pull on the valve is lessened and it raises until the pressure is great enough to make it possible for the down-pull of the remaining two pneumatics to equal the up-pull of the spring pneumatic. It will readily be seen that the different steps are obtained by admitting atmospheric air to the different intensity pneumatics singly or in combination. Quick accents are produced by stepping the pressure up just as the note to be accented is played and instantly stepping back again.

How the Step Mechanism Works

Regulated air is admitted to the three little intensity pneumatics through three valves which are located on a wind chest supplied with regulated air the same as goes to the striker pneumatics. These three secondary valves, as they are called, are in turn controlled by three primary valves located in a high tension wind chest exhausted direct from the pump.

It can be readily seen that decreasing the down-pull on the regulator valve is equivalent to increasing the up-pull. To produce a quick step change the down-pull of one or more of the intensity pneumatics is suddenly released by admitting atmospheric air to it.

The intensity pneumatics have different pulling powers on the regulator valve on account of their different locations on the lever

arm. The one nearest the valve stem has the greatest effect while the one nearest the fulcrum has the least.

The valve nearest the fulcrum is called the No. 1 intensity valve and is controlled by the No. 2 hole in the tracker (counting from the treble end for the treble regulator and from the bass end for the bass regulator). With no intensity valves raised the loudness of the playing called No. 1 intensity.

The following table shows the settings for the various intensities of playing:

Intensity of Playing	Intensity Valves Open	Holes in Tracker Open
No. 1	None	None
" 2	No. 1	No. 2
" 3	" 2	" 4
" 4	" 3	" 6
" 4	" 1, " 2*	" 2, " 4
" 5	" 1, " 3	" 2, " 6
" 6	" 2, " 3	" 4, " 6
" 7	" 1, " 2, " 3	" 2, " 4, " 6

*(Alternative setting.)

In order that the sides of the note sheet will not be filled with intensity perforations a lock valve is provided for each primary valve, and a single cancel valve controls all the lock valves. Each primary valve is supplied with a bleed but this bleed is not placed directly between the windchest and the tracker duct as is the case with the bleeds of the primary valves of the striker pneumatics.

A channel from the primary valve leads to the lock valve and thence to the bleed.

When the primary valve is down suction is admitted to the underside of its pouch through the bleed, but when the valve raises, atmospheric air passes over the lock valve and through the bleed to the pouch, thereby locking the valve open.

When the lock valve is raised it shuts off the channel from the primary valve and connects the bleed with the windchest thereby neutralizing the pouch and allowing the valve to come back to its seat.

The cancel valve acts as the primary valve for all three lock valves and when it is sprung from the No. 7 hole in the tracker all three lock valves

are raised, and any primary valve which is up will drop back. If, however, a primary valve tracker hole is open simultaneously with the lock valve, the primary valve will remain up because more air is admitted to the pouch than can be withdrawn through the bleed. If the cancel valve hole in the tracker is closed before the primary valve hole, the lock valves will drop, and the primary valve which was open will remain locked open.

This is accomplished by having the primary valve perforation in the note sheet a little longer than the lock valve perforation. For instance: If the alternative setting of No. 4 intensity is on, No. 1 and No. 2 valves will be open. Now if we wish to drop back to No. 3 intensity, the cancel valve hole No. 7 will be open at the same time as the No. 4 hole, but the No. 4 hole in the note sheet will be extended a little beyond the No. 7 so that the No. 2 valve will be held open not only while the No. 7 hole cancels the No. 1 valve, but long enough to let the lock valves return to their lower seats, when the No. 2 valve will then keep itself locked open. This kind of setting is very frequent in the note sheets.

The loudness of the No. 1 intensity is adjustable as will be explained further on, but the other steps are not adjustable in their relative loudness to the No. 1.

How the Spring Pneumatic Mechanism Works

As was explained before, the three little intensity pneumatics tend to close the regulator valve while the spring pneumatic pulls up and tends to open it. By admitting atmospheric air to any of the intensity pneumatics an instant decreasing in the down pull on the regulator valve takes place, and therefore an instant change in the loudness of the playing.

Increasing the up-pull on the valve produces exactly the same effect as decreasing the down-pull and it is by gradually increasing the up-pull that crescendo effects in the playing are obtained. Step effects or accents being caused by changing the down-pull on the regulator valve, and crescendo effects being caused by changing the up-pull on it, makes it possible to produce both these effects at the same time.

The spring pneumatic is connected, by means of a rubber tube, to the

"crescendo bellows." This crescendo bellows is in turn connected to a little regulating valve by means of a small tube. After entering the valve board the channel passes into the metal speed regulating block which contains two little pointed adjusting screws which are for the purpose of timing the slow and fast movements of the crescendo bellows.

The air passes first through the slow adjustment, then through the fast adjustment, then to the little regulating valve. The pouch of this valve is connected by means of a channel to a pallet valve which is operated by a hook connected to the movable board of the crescendo bellows. There is an ordinary bleed connecting the pouch channel with the high tension windchest. The hook is of such a length that it engages the pallet valve just before the crescendo pneumatic becomes fully distended. The crescendo bellows is pulled open by a spring which is adjustable. This adjustment is for the purpose of setting the No. 1 intensity to the right loudness.

Now let us go back to the channel leading from the crescendo bellows to the little regulating valve. As before mentioned this channel passes through the slow adjustment, but there is a by-pass around this adjustment which is controlled by a by-pass valve consisting merely of a pouch which normally has atmospheric air under it so that it is distended against the by-pass channel, thereby keeping it closed. Normally all the air flowing to the crescendo bellows must pass the slow adjustment which is so set that it takes the bellows eleven seconds to close. Likewise it takes about the same time to open.

When the crescendo bellows is open nearly to its full extent the hook engages the pallet valve and opens it, thereby admitting atmosphere to the little regulating valve pouch and raising the valve. As soon as the crescendo bellows begins to close on account of the regulating valve being raised the hook allows the pallet valve to close and the valve again seats itself. The regulating valve actually floats between its upper and lower seats, mixing just enough atmosphere from above it with suction from below to produce the right degree of tension on the air in the crescendo bellows to counteract the spring.

The by-pass valve around the "slow" adjustment is controlled by an inside working primary valve, which in turn is controlled by the same pallet valve that controls the slow crescendo valve. If there is a sudden demand for exhaust, caused for instance by the playing of a big chord, there will be a perceptible movement of the regulating valve and likewise

the spring pneumatic will close a little and the crescendo bellows open somewhat, thereby lifting the pallet valve away from its seat further than normal. The channel from the inside working primary valve is located nearer the fulcrum of the pallet valve so that it does not open effectively until after the other hole is wide open. When this sudden demand takes place not only is the latter hole opened wide enough to cause the little regulating valve to go up against its upper seat, but the primary valve hole is also opened and this causes the primary valve to open, thereby admitting suction to the pouch of the by-pass valve which allows the air to flow through the by-pass around the slow adjustment. The flow of this air is then only constricted by the fast adjustment, which allows the crescendo bellows to close much faster. This faster motion brings the movable board of the crescendo back to its normal position very quickly, so that normal conditions are almost instantly restored.

How Crescendo Effects Are Obtained

From the two ducts controlled by the pallet valve are two branches. The one leading from the little regulating valve duct connects with the No. 1 hole in the tracker while the one leading from the inside primary valve duct connects with the No. 5 tracker hole.

The tension of the air in the spring pneumatic is of course the same as in the crescendo bellows, and as the setting of the spring determines the tension of the air in the crescendo bellows and spring pneumatic, it likewise determines the loudness of the playing. When everything is normal the pallet valve controls the position of the crescendo bellows, but when the No. 1 hole in the tracker is opened atmosphere is admitted to the little regulating valve pouch faster than the bleed can exhaust it, and the valve is raised so that suction, without any mixture of atmosphere, is admitted through the fast and slow adjustments to the crescendo bellows which is slowly collapsed. If the No. 5 hole in the tracker is opened at the same time as the No. 1, the crescendo bellows will collapse at the fast speed.

As the bellows closes it stretches the spring, thereby causing it to pull harder. This spring is designed so that its pull when the crescendo bellows is almost completely closed is just sufficient to produce tension enough on the air within the crescendo bellows and spring pneumatic to pull up on the main regulator valve enough to raise the loudness of the playing to the level of the No. 7 intensity which is the loudest.

As the crescendo bellows closes *gradually* the pull of the spring like-

wise gradually increases and thus is produced a gradual rise in the loudness of the playing, which is a crescendo.

Under these conditions the little regulating valve ceases to perform its function as a regulator and becomes the controlling valve of the slow crescendo. It is therefore generally called the slow crescendo valve, while the inside primary valve when operated from the tracker becomes the fast crescendo valve, and is usually so called.

To produce a slow crescendo the No. 1 hole in the tracker is opened. When the hole is then closed a slow decrescendo takes place. To produce a full speed crescendo the No. 1 and No. 5 holes in the tracker are opened. If both holes are then closed a slow decrescendo takes place, but if only the No. 1 hole is closed and the No. 5 kept open a full speed decrescendo takes place. If the No. 1 hole in the tracker is opened by a series of perforations two inches long separated about one inch, a half speed slow crescendo is produced for the crescendo is on for two inches of the note sheet and off for an inch, then on again for two, etc. If an unbroken slow crescendo perforation is in the note sheet and with it are a series of short fast crescendo perforations the effect will be a crescendo the speed of which is intermediate between the slow and fast. By varying the intervals between the short fast crescendo perforations different intermediate speeds are obtained.

Connected to each side of the windchest is a small pneumatic with a long spring. Inside this pneumatic is a small bumper spring. This pneumatic is a regulated tension reservoir and is for the purpose of taking some of the work of regulating off the regulating valve when various numbers of notes are being played at low intensities. It keeps the regulator from "jumping."



ADJUSTMENTS

Regulator Valve Stem

The lever to which is connected the intensity pneumatics should be adjusted to the valve stem so that when the valve is closed the three intensity pneumatics will be open equal amounts.

This is set correctly in factory, and should not be disturbed.

Slow Crescendo

The speed of the slow crescendo is adjusted by the little set screw marked "slow."

Turning the screw in slightly, makes the crescendo slower.

A little shellac put around the screw after it is adjusted will keep it from leaking.

It should require eleven seconds to close and about the same to open.

If it is a little bit slow or fast opening it will cause no trouble.

The limits of adjustment given on the Inspection Test Roll are correct, and adjustments should be made with this roll.

Fast Crescendo

The speed of the fast crescendo is adjusted by the little set screw marked "Fast."

Turning the screw in slightly, makes the crescendo slower.

A little shellac put around the screw after it is adjusted will keep it from leaking.

It should require two seconds to close and about the same to open.

If it is a little bit slow or fast opening it will cause no trouble.

The limits of adjustment given on the Inspection Test Roll are correct, and adjustments should be made with this roll.

No. 1 Intensity

The loudness of the No. 1 Intensity is adjusted by the screw which holds the spring on the crescendo pneumatic.

Turning the screw in weakens the spring and softens the No. 1 Intensity.

Turning the screw out strengthens the spring and makes the No. 1 Intensity louder.

The tension of the air on No. 1 Intensity, with the modifying lever at normal, should be 5 inches water pressure.

If you do not use a gauge the No. 1 Intensity can be adjusted as explained in the "Inspection Test."

LOCATING TROUBLES

If in testing the Expression Mechanism it is found that something does not work properly, do not immediately begin to pull the mechanism apart, for it may be possible to correct the trouble without taking a single screw out.

The best way to locate any trouble is by a process of elimination. For instance, if it is found, in making an inspection test, that the crescendo pneumatic does not collapse when the No. 1 hole in the tracker is opened, the first thing to do is to remove the tube leading from the tracker, where it connects to the crescendo mechanism. If the crescendo bellows then works it shows the trouble is in the tube which is most likely stopped up.

In the first place you have eliminated the necessity of examining every detail of the crescendo mechanism, because you have shown that the trouble is somewhere between the tracker and the other end of the tracker tube. In the second place you have eliminated the necessity of looking over all the various places where trouble could occur between the tracker bar and the other end of the tube without really knowing that the trouble is in the tube.

It is bad practice to locate trouble by examining every possible place where it might occur, starting at the tracker bar and working step by step through ever detail of the mechanism. The method of dividing all the places which might be the cause of the trouble into halves and thereby locating the trouble in one of the halves and then dividing the half in which the trouble is located into two parts, etc., is much quicker and more positive.

Sometimes there is trouble in both halves but even then it can be located by this method more easily than by the step by step process.

Always Locate the Trouble Before Taking Anything Apart.

By following the elimination process as far as possible you will almost always be able to find out what is out of order before you do a thing toward repairing it.

If you will study this book carefully and thoroughly understand exactly how every part of the Ampico works you will be surprised how easy it is to locate any trouble and fix it in a short time.

How to Rubberize a Pouch

The rubber cement used should be kept in a small bottle and be just a little thicker in consistency than water. Rubber cement such as sold by automobile supply houses and used for cementing patches to tubes is all right if it is thinned with naptha (not commercial gasoline). "Anchor Brand" rubber cement sold by the Woolworth 5c and 10c Stores does not need thinning.

Apply the cement with a small brush while sucking vigorously on the pouch with a suck tube so as to draw the cement into the pores of the leather. Let the first coat dry and apply a second, but not without sucking on the pouch.

Apply as many coats as necessary to make the pouch tight.

Paint the cement on neatly and cover only the portion of the pouch that is drawn down by the sucking. Do not get any cement on the outside rim of the pouch where it is glued down.

Apply talcum powder to pouch after last coat of cement is dry. This is necessary and will keep the surface of the pouch from being sticky.

Clean the brush with gasoline immediately after using as it does not clean easily after drying.

The Suck Tube

A suck tube made of a piece of rubber tracker tubing about two feet long with a straight nipple in one end is indispensable in testing a player.

The Listening Tube

A listening tube is nothing more than a two foot piece of $\frac{3}{8}$" rubber tubing used for the purpose of locating small leaks and noises. It is a crude stethoscope.

Electric Extension Cord

A very handy addition to the repairman's kit is a piece of extension cord about a foot long with a push plug at one end and a socket to fit same at the other with a branch about six feet long with an "Edison" screw socket at the end. The two wires of the branch should be spliced to the two wires of the cord. In using same pull out the motor plug and put it into the socket of the extension cord. Put the plug of the extension cord into the motor socket and with a roll in the player and the tempo set at zero, turn on the electric switch. If you wish to stop the motor pull the motor plug.

A bulb can always be borrowed where you are working.

Be sure that the push plug and socket are the same standard as is used on the Ampico.



POSSIBLE TROUBLES WITH EXPRESSION MECHANISM

Intensity Valves

In diagnosing trouble in the intensity valves see that the primaries are working properly before attempting to repair the secondaries.

ONE PRIMARY INTENSITY VALVE STAYS OPEN when tracker hole is closed and cancel valve is open.

First remove tube from cancel valve so primary valve cannot lock open.

Remove tracker tube where it connects to primary valve box and stop end of nipple with finger.

(a) IF VALVE CLOSES the tube leaks.

Replace tracker tube on valve box.

Pinch tube where it enters automatic expression cut-out.

If valve closes it shows there is a leak between point where tube is pinched and tracker bar.

If valve remains open trouble is between point where tube is pinched and expression mechanism.

Further elimination will exactly locate leak.

(b) IF VALVE DOES NOT CLOSE trouble is in mechanism.

Connect suck tube to valve box and blow and suck vigorously to clean bleed.

Press valve down with finger to see if it is stuck to lower seat or if there is dirt on upper seat.

Shut off power and press valve down with finger. If it comes up again take valve box apart and find cause. It may be that pouch has shrunk. In such a case new pouch must be laid.

Valve should have a little less than $\frac{1}{32}$" inch motion.

Remove lock valve cover and see that lock valve is not stuck to its lower seat. (In replacing lock valve cover be careful not to get it turned around.)

Disc may have come off lock valve pouch. This can be seen with valve out. Primary valve box will have to be taken apart to fix this.

ONE PRIMARY INTENSITY VALVE STAYS CLOSED when tracker hole is open.

First remove tube from cancel valve so primary valve cannot lock open.

Remove tracker tube where it connects to primary valve box.

(a) IF VALVE OPENS trouble is in tube: probably clogged.

Replace tube at valve box. Disconnect tube leading to valve box at automatic expression cut-out.

(a-a) IF VALVE OPENS trouble is towards tracker.

Attach suck tube to automatic expression cut-out and clean out obstruction.

(b-b) IF VALVE STAYS CLOSED trouble is in tube between automatic expression cut-out and primary valve box.

Clean out this tube.

(b) IF VALVE STAYS CLOSED trouble is in primary valve box.

Try valve with finger to see if it has motion enough. Motion should be a little less than $\frac{1}{32}''$. If valve has not motion enough it may be possible to drive stem down; but great care must be used not to drive it too far.

Apply suck tube and see if channel is clogged.

If channel is very free, pouch is loose, and valve box must be taken apart to repair pouch.

See that tubes are not crossed anywhere. In other words, see that the tube which connects with the valve giving trouble leads to the right hole in the tracker. No. 1 valve which is nearest the fulcrum of the lever arm should connect with No. 2 hole in the tracker. No. 2 valve should connect with No. 4 tracker hole. No. 3 valve, which is nearest regulator valve stem, should connect with No. 6 tracker hole. Try out the tubes by connecting a suck tube to the lower end and sucking through same; determining with the test roll which hole the air is coming through.

ONE PRIMARY INTENSITY VALVE DOES NOT LOCK OPEN when its hole in tracker is closed after being opened with cancel valve hole closed.

Remove lock valve cover. (Use care when replacing same.)

See that lock valve does not stick to upper seat.

Look for piece of dirt on lower seat.

See that lock valve drops freely on to lower seat. If it does not, start motor and operate cancel valve with finger to see if pouch gives valve lots of motion.

(a) IF IT DOES NOT HAVE MOTION enough, pouch has shrunk and new pouch must be laid.

(b) IF IT HAS MOTION ENOUGH valve can be made to seat by cutting a very little off end of stem. Not more than 1/32" at first.

ALL PRIMARY INTENSITY VALVES STAY OPEN when cancel valve hole in tracker (No. 7) is open and primary valve holes in tracker are closed.

See if cancel valve works properly when hole in tracker is opened and closed with finger. Its motion should be a little less than 1/32".

(a) IF CANCEL VALVE DOES NOT WORK trouble is with cancel valve.

Remove cancel valve tracker tube at primary valve box.

(aa) IF VALVE RAISES tube is clogged.

(bb) IF VALVE STAYS CLOSED trouble is in primary valve box.

Proceed in both cases the same as you would with primary valve, as explained previously.

(b) IF CANCEL VALVE WORKS PROPERLY trouble is in lock valves.

If one lock valve pouch is loose where it is glued down, the leakage would cause all three lock valves to be inoperative.

ALL PRIMARY INTENSITY VALVES DO NOT LOCK OPEN.

Trouble is probably in cancel valve staying open.

Remove tracker tube where it connects to primary valve box and stop end of nipple with finger.

(a) IF VALVE CLOSES trouble is in tube.

(b) IF VALVE STAYS OPEN trouble is in valve mechanism.

Proceed in both these cases the same as you would with primary valve that stays open.

If cancel valve works properly look for trouble in lock valves. They probably do not seat properly. See "One Primary Intensity valve does not lock open."

SECONDARY INTENSITY VALVE STAYS CLOSED when primary is open.

With air off, try secondary valve with finger to see if it works freely. It should have a little less than $\frac{1}{32}$" motion.

Remove primary tube where it connects to secondary valve box.

(a) **IF VALVE OPENS** trouble is in lock valve. Connect suck tube to the tube which you have removed from the secondary valve and blow and suck vigorously. If this does not correct trouble, remove lock valve cover and find out what prevents the lock valve from seating.

Blow and suck it out thoroughly, or locate obstruction.

(b) **IF VALVE STAYS CLOSED** trouble is in secondary valve box.

Valve may be stuck down to its seat.
Valve may have too little motion.
Pouch may be loose.
Disc on pouch may have to come off.
Channel to pouch may be clogged. Try suck tube to see if pouch works.

SECONDARY INTENSITY VALVE STAYS OPEN when primary is closed.

Try secondary valve with finger to see if it works freely.
Remove primary tube where it connects to secondary valve box and stop end of nipple with finger.

(a) **IF VALVE CLOSES** tube or channel to primary leaks or primary valve is not seating properly.

Find leak and repair it.

(b) **IF VALVE STAYS OPEN** trouble is in secondary valve box.

Test with suck tube for leak in secondary pouch channel.
Shut off power and if valve stays up, press it down with finger.
If it comes up again pouch is shrunk and new one must be laid.

LOCK VALVE STAYS OPEN when tracker hole is closed.

See paragraph on "ALL PRIMARY VALVES DO NOT LOCK OPEN."

LOCK VALVE STAYS CLOSED when tracker hole is open.

See paragraph on "ALL PRIMARY VALVES STAY OPEN, ETC."

CRESCENDO MECHANISM

With the crescendo (No. 1) and fast crescendo (No. 5) holes in the tracker closed, the crescendo pneumatic should be nearly wide open with the hook, which is fastened to its movable board, in contact with the pallet valve and the pallet valve barely held off its seat.

CRESCENDO PNEUMATIC WILL NOT COLLAPSE with No. 1 hole in tracker open.

Disconnect slow crescendo tube from crescendo valve box (this is the tube nearest the hook which operates the pallet valve.)

(a) IF THE CRESCENDO PNEUMATIC SLOWLY CLOSES the trouble is in the tube. Probably clogged or crossed.

Proceed as in (a) of "ONE PRIMARY INTENSITY VALVE STAYS CLOSED."

(b) IF THE CRESCENDO PNEUMATIC DOES NOT COLLAPSE the trouble is in the crescendo mechanism.

See if the crescendo pneumatic is in its normal position, which is described at beginning of this paragraph. To test this further shut off electric motor and crescendo pneumatic should open wider and pull pallet valve well off seat.

If when the air is turned on the crescendo pneumatic does not close enough to let pallet valve nearly reach its seat, the slow crescendo valve must be tested.

Open and close end of nipple with finger and listen to determine if valve is working.

Slow crescendo valve should have a little less than 1/32" motion.

(a-a) IF VALVE OPERATES PROPERLY.

See that channel leading from slow crescendo valve to crescendo pneumatic is free.

This channel may be clogged at the slow crescendo adjustment. By turning the "slow" crescendo adjustment screw out a little the obstruction will probably clear itself.

If this has been the trouble the crescendo will then collapse.

The speed of the crescendo must then be adjusted.

See that the crescendo pneumatic or spring pneumatic does not leak badly.

Test this by disconnecting the tube which connects the crescendo pneumatic to the spring pneumatic and stop up the crescendo pneumatic tube with finger. If the crescendo now works it shows that the spring pneumatic leaks.

If the crescendo still does not work, it leaks.

(b-b) IF THE VALVE DOES NOT OPERATE PROPERLY.

Proceed about as in (b) of "ONE PRIMARY INTENSITY VALVE STAYS CLOSED."

CRESCENDO WILL ONLY COLLAPSE PART WAY with No. 1 hole in tracker open.

See that pump is supplying properly.

Disconnect slow crescendo tube from crescendo valve box.

(a) IF CRESCENDO THEN OPERATES PROPERLY the trouble is in the tube leading from the tracker bar, which is somewhat clogged and allows only enough air to pass through it to partly neutralize the bleed.

Proceed as in (a) of "PRIMARY INTENSITY VALVE STAYS CLOSED."

(b) IF CRESCENDO STILL DOES NOT CLOSE PROPERLY the trouble is in the crescendo mechanism.

Pinch muffler tube on slow crescendo valve or if there is no muffler tube, stop atmosphere hole in valve with finger.

(a-a) IF THE CRESCENDO THEN WORKS PROPERLY the trouble is in the slow crescendo valve.

See if valve operates properly.

See if there is dirt on upper seat.

(b-b) IF THE CRESCENDO STILL DOES NOT WORK PROPERLY look for leak in crescendo pneumatic or spring pneumatic. Test for leak as described in latter part of (a-a) of "CRESCENDO PNEUMATIC WILL NOT COLLAPSE.

Look for leak in channel between slow crescendo valve and small tube leading to crescendo pneumatic.

CRESCENDO PNEUMATIC STAYS ENTIRELY COLLAPSED with No. 1 hole in tracker closed.

Disconnect slow crescendo tube from crescendo valve box and stop end of nipple with finger.

(a) IF PNEUMATIC THEN OPENS trouble is in tube.

Proceed about as in (a) of "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

(b) IF PNEUMATIC STILL STAYS COLLAPSED trouble is in crescendo valve mechanism.

See if pallet valve seats properly. Look for dirt on its seat.

Press pallet valve against its seat to be sure that it is tight and if crescendo pneumatic does not then open, look for leak between top and bottom boards of valve box at end where pallet valve is located. Tighten screws which hold the two boards together. (The later models have an outside connecting tube from the top board to the lower board.)

Shut off power and remove upper seat of slow crescendo valve. See if valve drops back against its lower seat freely. If it does not, the pouch may have shrunk.

See if slow crescendo valve works freely, and has a little less than ½" motion.

CRESCENDO PNEUMATIC STAYS PARTLY COLLAPSED with No. 1 hole in tracker closed.

Disconnect slow crescendo tube from crescendo valve box and stop end of nipple with finger.

(a) IF PNEUMATIC THEN OPENS trouble is in tube.

(This condition could be caused by slight leak in tube.)

Proceed as in (a) of "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

(b) IF PNEUMATIC STILL STAYS COLLAPSED trouble is in crescendo valve mechanism.

Proceed as in (b) of "CRESCENDO PNEUMATIC STAYS ENTIRELY COLLAPSED."

CRESCENDO PNEUMATIC OPENS MUCH FASTER THAN IT COLLAPSES

Look for slight leak in crescendo pneumatic or spring pneumatic. Test for leak as described in latter part of (a-a) of "CRESCENDO PNEUMATIC WILL NOT COLLAPSE".

Look for dirt on upper seat of slow crescendo valve.

Look for leak in channel between slow crescendo valve and crescendo bellows.

See that there is no leakage under metal crescendo adjusting screw block, or around slow or fast adjusting screws. (A little shellac around adjusting screws will stop leakage.)

CRESCENDO PNEUMATIC OPENS MUCH SLOWER THAN IT COLLAPSES

Look for dirt under pallet valve.

Look for dirt on lower seat of slow crescendo valve.

Look for seepage through fast crescendo by-pass pouch.

To test this pouch for seepage the valve block must be taken apart and the nipple of the suck tube pushed into the hole in the lower board which connects with the pouch chamber. Suck on tube and see if air holds when end of tube is stopped with tongue.

If there is the slightest leak, rubberize the pouch. (See instruction for rubberizing pouch.)

SLOW CRESCENDO TOO SLOW but collapses and opens at about the same speed.

Look for dirt in slow crescendo adjustment. (It may be necessary to remove slow crescendo adjustment screw, although the dirt may be sucked through if the screw is loosened).

SLOW CRESCENDO TOO FAST but collapses and opens at about the same speed.

Remove fast crescendo tracker tube where it connects to crescendo valve box and stop end of nipple with finger.

(a) IF CRESCENDO THEN WORKS AT PROPER SPEED trouble is in tube.

Proceed as in (a) of "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

(b) IF CRESCENDO STILL WORKS TOO FAST see if fast crescendo primary valve works properly.

(a-a) IF IT DOES NOT WORK PROPERLY and stays open:

Proceed as in (b) of "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

(b-b) IF IT DOES WORK PROPERLY

Look for dirt on fast crescendo by-pass valve seat.

Look for leak in channel between primary valve and by-pass pouch chamber.

Look for leak from one channel to another under crescendo adjusting screw block.

FAST CRESCENDO TOO SLOW but collapses and opens at about the same speed.

Remove fast crescendo tracker tube where it connects to crescendo valve box.

(a) IF THE CRESCENDO THEN WORKS FAST ENOUGH the trouble is in the tube.

Proceed as in (a) of "PRIMARY INTENSITY VALVE STAYS CLOSED."

(b) IF THE CRESCENDO STILL WORKS TOO SLOW trouble is in crescendo valve box.

See if fast crescendo valve works properly.

(a-a) IF VALVE DOES NOT WORK PROPERLY proceed as in (b) of "PRIMARY INTENSITY VALVE STAYS CLOSED."

(b-b) IF VALVE DOES WORK PROPERLY.

Look for dirt in fast crescendo adjustment.

See that channel from by-pass valve to crescendo pneumatic is free.

See if by-pass valve works properly. (The valve box will have to be taken apart to see if the by-pass pouch has plenty of motion, etc.)

FAST CRESCENDO TOO FAST but collapses and opens at about same speed.

Look for leak between channels under crescendo adjusting screw block.

EXPRESSION BUTTONS AND MODIFYING DEVICE

THE EXPRESSION BUTTONS are for the purpose of giving hand expression to ordinary music rolls or to Ampico Reproduction Rolls when the automatic expression lever is in the "off" position.

The modifying device is for the purpose of adjusting the loudness of the playing of the Ampico to fit the size of the room or the desires of the listener.

The Expression Buttons and the loud side of the Modifying Device control a pneumatic which acts directly on the stem of the expression regulator valve, while the soft side of the Modifying Device controls a pneumatic which operates the re-regulator valve. This valve is called the re-regulator valve because its function is to re-regulate the tension of the air after the main expression valve has regulated it. It softens the playing, without losing the dynamic effects, by means of proportionately reducing the tension of the air.

If the No. 6 intensity is 18 inches water pressure with the modifying lever at normal it would be about half that with the lever at the extreme soft position as the re-regulator is designed to reduce the tension of the air by about one-half on the higher intensities.

As the No. 1 intensity, which is about 5 inches water pressure, is as soft as the instrument will play properly it would not do to re-regulate this pressure to one-half, or 2½ inches. To overcome the effect of the re-regulator on the No. 1 intensity a small spring is placed on the valve stem with just tension enough to counteract the pull of the re-regulator pneumatic on No. 1 intensity. As the playing intensity rises, the effect of the spring is gradually overcome until when the highest intensity is reached its effect on the re-regulator pneumatic is barely felt.

The buttons are supplied with air under high tension while the modifying device uses regulated tension taken from the treble and bass chests of the striker pneumatics.

The tube leading from the treble expression button to the treble loudening pneumatic passes through the treble chamber of the loudening plunger of the modifying device. Similarly on the bass side.

The principle of the Expression Buttons and the Modifying Device is exactly the same. When the Button is in its normal position, as shown

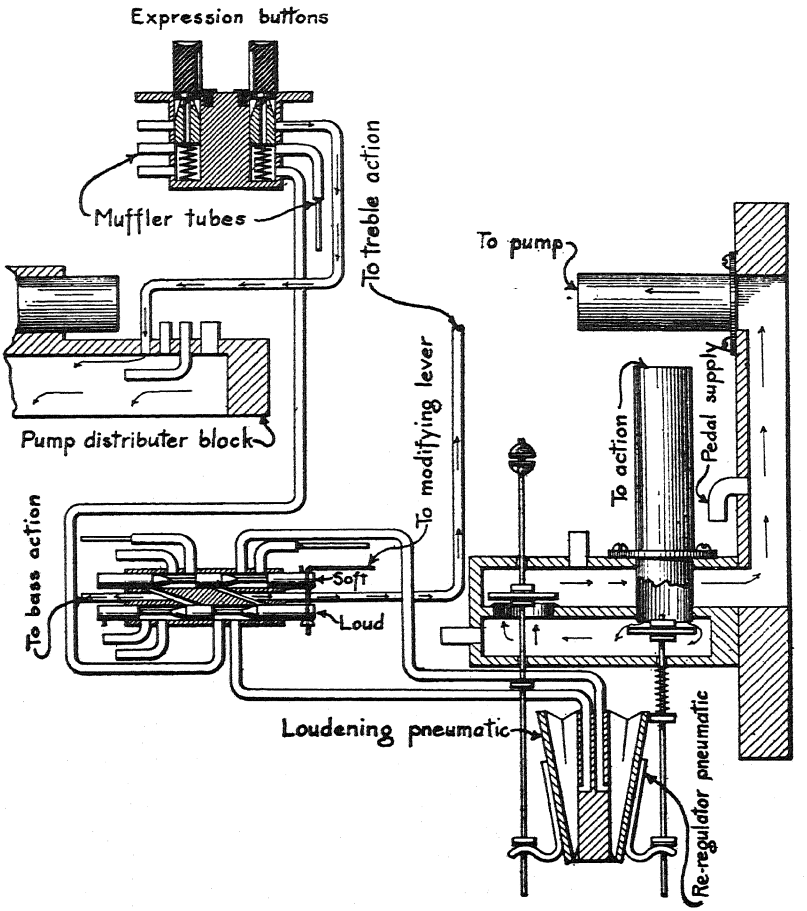


Diagram of Expression Buttons and Modifying Device

in the sectional drawing, the supply to the plunger cylinder is shut off by the plunger. The atmosphere port of the plunger cylinder is wide open, thereby admitting atmosphere freely to the loudening pneumatic.

As soon as the Button is depressed a little the bottom of the plunger closes somewhat the atmosphere port and the neck of the plunger opens the supply port a little and admits a small supply of suction to the cylinder through the channel in the center of the plunger. The tension of the suction admitted to the cylinder is greatly reduced by the inrush of atmosphere through the atmosphere port which is only slightly closed by the bottom of the plunger. This tension is not completely neutralized, however, and the remaining small amount of tension is communicated to the loudening pneumatic through its tube and tends to collapse the pneumatic and gently press up on the regulator valve stem.

As the Button is depressed further more tension is admitted to the cylinder and less atmosphere and the result is a greater up-pull on the regulator valve stem. The greater this up-pull, the louder will be the playing until when the Button is completely depressed and the atmosphere entirely shut off from the cylinder, the up-pull on the regulator valve stem becomes so great that it overcomes the down-pull of the intensity pneumatics and the playing is the loudest.

The upper plunger of the modifying device, as shown in the illustration, is the softening plunger, the right end of which controls the treble re-regulator; the left end the bass. The lower plunger is the loudening plunger, the right and left ends controlling the treble and bass respectively.

The connecting tube from the treble Expression Button is the atmosphere tube of the loudening device. The treble and bass supply tubes of both the loudening and the softening devices enter the Modifying Device between the two plungers and spread obliquely to each cylinder. The two plungers are operated by one shifting lever and it will be seen that when they move to the right, the supply ports of the lower cylinder are gradually opened and the atmosphere ports gradually closed, while the ports in the upper cylinder are not opened or closed. When the plungers are moved to the left the conditions in the lower cylinder do not change but in the upper cylinder the supply ports are gradually opened and the atmosphere ports gradually closed.

The atmosphere ports on the buttons and the softening cylinder are supplied with muffler tubes to stop the hissing.

ADJUSTMENTS

Loudening Pneumatic

The collar on the valve stem should be adjusted with the power off and the regulator valve stem pressed down so that the valve rests on its seat.

There should be a very slight play between the collar on the valve stem and the arm of the pneumatic.

Softening Pneumatic

The collar on the valve stem should be adjusted so that when the pneumatic is collapsed to ¼" opening, the valve is pressed closed against its seat.

Both sides should be adjusted the same so there will be no difference in the softness of the playing.

Spring on Softening Valve Stem

The softening device must not affect the No. 1 intensity or softest playing. If it does there will be many notes in soft passages that will not play properly with the softening device "on."

The spring should be strong enough to keep the No. 1 intensity from sounding any softer, but not so strong as to keep the No. 4 intensity from sounding noticeably softer.

Be sure that both sides are adjusted alike.

POSSIBLE TROUBLES

The only trouble to be anticipated with the Expression Buttons or the Modifying Device is the possibility of the pneumatics leaking or of the plungers sticking.

If an Expression Button sticks, remove the brass name plate, take out the machine screw which prevents the plunger from coming out, lift out the plunger and clean it thoroughly. The cylinder in which the plunger works must also be cleaned.

If the Modifying Lever works too hard the plungers and the cylinders of the Modifying Device Block must be cleaned. It is best to remove one plunger at a time to insure getting it back in its proper place. The block can be cleaned by drawing a narrow piece of strong cloth back and forth through the cylinder.

Never use oil on the plungers of either the Expression Buttons or Modifier, as it is sure to accumulate dirt and gum up in time. The plungers should be cleaned with a dry cloth and the clean surfaces should not be touched by the hands when replacing them. In extreme cases crocus cloth can be used, after which the crocus must be cleaned off with a soft cloth.

If the effect on the treble and bass pneumatics is markedly different when the control handle is a little way toward "loud" or "soft," see that the plungers are being drawn

out equal distances. If they are, examine the pneumatic which seems to contain the least suction for possible leakage.

With handle at "normal" if one of the pneumatics contains suction see that the muffler tube on its respective air port is not kinked or pinched shut.

AUTOMATIC EXPRESSION CUT-OUT

THE FUNCTION of the Automatic Expression Cut-out is to shut off the automatic expression devices of the Ampico with the exception of the loud pedal, and set the loudness of the playing at the softest intensity so that the expression buttons may be used to control the dynamic expression by hand.

When the Automatic Expression Cut-out switch in the spool box is in the "on" position all the expression tubes have free passage through the Automatic Expression Cut-out, but when the switch is in the "off" position the three intensity tubes, the crescendo tubes, the soft pedal tube, and the rewind tube are closed off, while the cancel tubes are opened to atmosphere.

This shuts off the operation of all the valves to which these tubes connect, leaving the dynamic mechanism set at the No. 1, or softest intensity.

The loud pedal tube runs into the Automatic Expression Cut-out and passes through a sieve but is not affected by the operation of the Cut-out as regular music rolls contain loud pedal perforations. There is a loud pedal cut-out switch in the spool box which can be operated by hand when one wishes to cut out the automatic loud pedal.

All of the tubes which are closed off by the operation of the Cut-out mechanism pass from the tracker bar to individual sieve chambers. (See right end of the drawing where a cross section of the "1B" tube channels, etc., is shown). These sieves catch any dirt which may come in from the tracker bar. A brass nipple leads from the inside of the sieve to the center of the pouch chamber. From the outside edge of the pouch chamber the tube leads to the valve it controls. The chambers on the under sides of all the pouches are connected to a channel which runs the full length of the cut-out mechanism and this channel is supplied with high tension suction from the Automatic Expression Cutout switch when it is in the "on" position and with atmosphere when it is "off."

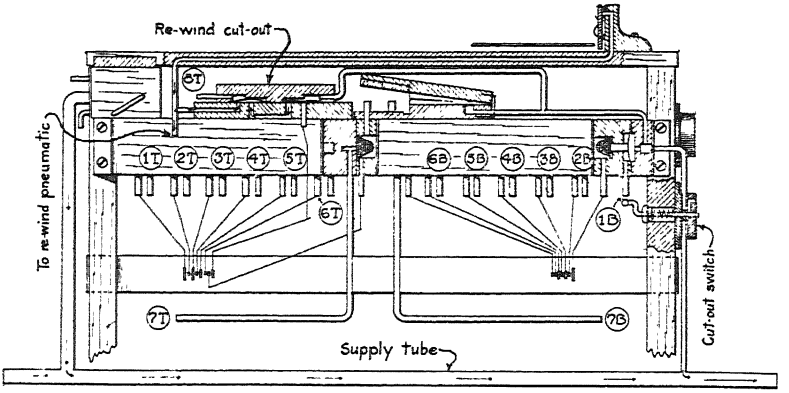


Diagram of Automatic Expression Cut-Out Mechanism

When the channel is supplied with suction the pouches are pulled away from the central nipple and free passage through the tubes allowed; but when the channel is supplied with atmosphere, the bleeds of the various valves exhaust the air on the top sides of the pouches and they are thereby sucked up against the ends of the center nipples which closes off the channels from the tracker bar.

The cancel valve tubes run into sieve chambers (see section in middle of drawing) and from thence to the valves they control. A branch tube leads from the sieve chamber to the outside of the Cut-out where it is shut off by a small pneumatic when the switch is in the "on" position. This small pneumatic is connected to the channel and is drawn down when the channel is supplied with suction from the switch. When the channel is supplied with atmosphere the small pneumatic is opened by a small spring and uncovers the ends of the branch nipples thereby keeping the cancel valves up so that the intensity valves cannot by any chance get locked open.

The rewind tube (8T) is provided with a separate cut-out device consisting of a block equipped with two pouches and with channels as shown.

With cut-out switch in "on" position suction above neutralizes the right hand pouch and allows air to pass through to the action box when

No. 8 hole is opened. At "off," atmosphere is admitted above the pouch and the suction from bleed in the reverse action box draws the pouch down and closes off the tube. The upper side of the left hand pouch is connected to the channel leading from the spool-box running gear to the reverse cut-out valve in the pump. In the playing position the pouch is held neutral; when rewinding, atmosphere is admitted above the pouch allowing suction through the bleed in action box to draw the pouch down and close the port. This prevents the possible admission of air from the tracker bar while note sheet is rewinding and prevents the rewind valve from chattering.

There are no adjustments on the Automatic Expression Cut-Out.

POSSIBLE TROUBLES

If leakage in an expression tube is traced to the Cut-out the two screws which fasten the cut-out to the spool box should be taken out and the device turned over, exposing the screws that hold the pouch board in place. Tighten these screws and the trouble will be overcome.

Leakage of air between the rewind Cut-out pouch block and channel block will cause the reverse pneumatic to shift the reverse lever to the rewind position. Remedy this condition by tightening the four screws in pouch block and painting the joint with shellac to prevent its recurrence.



AUTOMATIC RE-WIND MECHANISM

THE RE-WIND is controlled from the eighth hole in the tracker (8T) on the treble side. The tracker tube runs to the re-wind cut-out and from thence to the re-wind valve box. The re-wind mechanism operates automatically only when the automatic expression switch is in the "on" position; otherwise the re-wind lever in the spool box or in the key-slip must be thrown by hand. The operation of the re-wind cut-out is explained under the heading "Automatic Expression Cut-out."

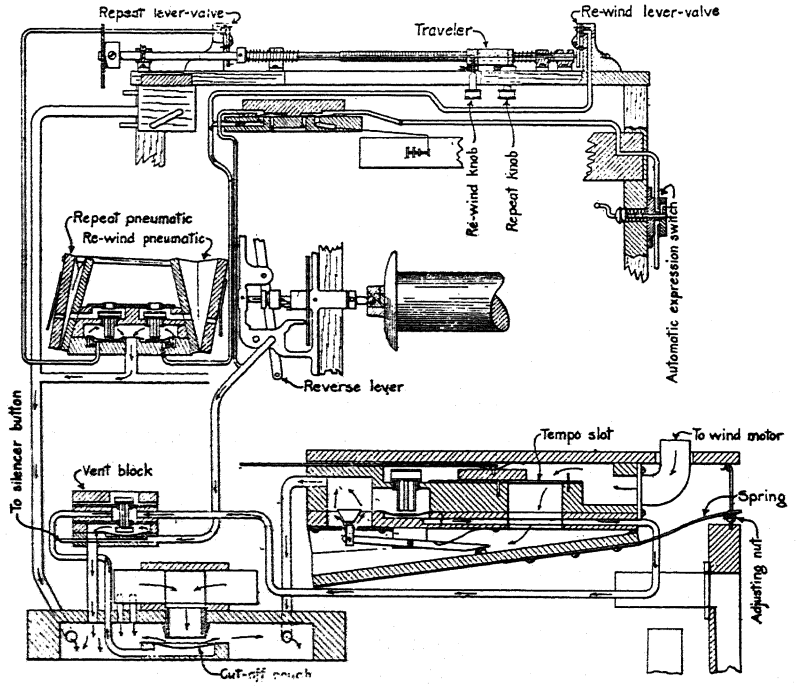


Diagram of Automatic Re-wind—Repeat Device—Wind Motor Governor—Reverse Cut-Out

When the re-wind perforation in the music roll uncovers the re-wind hole in the tracker atmosphere is admitted to the under side of the pouch in the re-wind action box and in the usual way causes the pneumatic to collapse and throw the re-wind lever to the "re-wind" position. The pneumatic is provided with a flap valve on its movable board the same as the re-play pneumatic of the repeat mechanism.

There are no adjustments on the rewind mechanism.

POSSIBLE TROUBLES

RE-WIND LEVER THROWS OVER as soon as player is started.

Be sure paper covers re-wind hole (8T).

Remove tracker tube from valve box and stop end of nipple with finger.

(a) IF RE-WIND LEVER DOES NOT THROW OVER the tube leaks.

See troubles under "AUTOMATIC EXPRESSION CUT-OUT."

(b) IF RE-WIND LEVER STILL THROWS OVER the trouble is in the valve.

Proceed about as in (b) of "ONE PRIMARY EXPRESSION VALVE STAYS OPEN."

RE-WIND DOES NOT OPERATE

Be sure automatic expression switch is "on."
Remove tracker tube from valve box.

(a) IF RE-WIND WORKS trouble is in tracker tube or a pouch of re-wind cut-out is stuck against its seat.

Apply suck tube and blow.

(b) IF RE-WIND STILL DOES NOT WORK trouble is in valve box.

Proceed about as in (b) of "ONE PRIMARY EXPRESSION VALVE STAYS CLOSED."

See that the reverse mechanism in the spool box running gear works freely.

RE-WIND OPERATES IN MIDDLE OF PIECE

See that "re-wind" button of repeat mechanism is loose.

See that re-wind wire in repeat mechanism is not stuck in traveler.

If the ends of the music roll are not pressed together firmly before it is inserted in spool box it is possible that the paper may be so uneven on the spool that it will not track and a No. 7 perforation comes into registration with the re-wind hole in the tracker.

See that tracking device is working properly.

Once in a great while a roll which is trimmed narrow on one side gets by the inspector in the music roll factory.

To determine if this is the cause of its not tracking proceed as follows: Exactly register perforations near the middle of the sheet with the tracker holes. If both edges of sheet are the same distance from tracker ears sheet is O. K. If one side is very narrow and the other side is right, the roll should be returned to the music roll factory with full explanations and a perfect roll will be sent in place of it

Once in a very great while a roll gets by the inspector in the factory, in which a perforation which is meant to be No. 7 is in the No. 8 position.

Paste up the hole with a little piece of paper or return roll to factory. (This accident has only been known to happen once or twice.)

REPEAT DEVICE

The Repeat Device enables the operator to repeat indefinitely any part or all of a music roll.

The device consists of a screw shaft which is rotated by the spool box running gear to which it is connected by a chain; a threaded traveler; and two valves controlling the pneumatics that throw the reverse lever to the re-winding and playing positions.

The back view of the Repeat Device is shown. Normally when starting to play the traveler is at the opposite end of the shaft.

In the playing position the traveler feeds on the shaft and moves to the right as the roll is wound on take-up spool. The thread is very "slow" and is long enough to prevent the possiblity, when a very long roll is used, of the traveler passing beyond it and thus becoming ineffective. Two wires pass through the traveler, one on either side of shaft. These wires are held by a light spring against their respective lever-valves. When neither button is turned "on" the traveler merely slides along the wires.

In setting the device to repeat an entire roll some latitude must be allowed to provide for the momentum of the music roll when rewinding. With a medium length roll the first speaking perforation should be allowed to pass about eight inches beyond the tracker bar before the repeat button is turned "on." If the roll is very long, allow about one foot. If this latitude is not considered the paper, as it finishes rewinding, may unwind so far off the take-up spool that the switch will throw off.

When rewinding, the shaft of Repeat Device is rotated in the opposite direction and the traveler moves to the right carrying the wire with it. When it reaches the point at which the "repeat button" was turned "on" the wire is again brought in contact with the repeat lever-valve which is forced open and air is admitted to the pouch which controls the repeat pneumatic. When this pneumatic collapses the reverse lever throws to the playing position again. This operation will continue indefinitely until the button is turned "off" when the wire is released from the traveler and the spring draws it back into contact with the control lever-valve.

If it is desired to repeat a certain portion of a piece, the "repeat" button is turned "on" as the beginning of that portion passes the tracker bar and the "re-wind" button is turned on as the last end of the portion which is to be repeated is reached. The player will then play that portion of the piece over and over until the buttons are released.

As the repeat and reverse pneumatics are mechanically connected one collapses when the other expands. Flap valves are provided on the outside to facilitate the expulsion of air and keep the fabric from bulging when the reverse lever is operated by hand.

There are no adjustments on the repeat device.

The thread of shaft is very fine and should be kept clean and oiled. Use only the best grade light oil on the bearings and screw, as a heavy oil may gum up and seriously interfere with its operation.

WILL NOT REVERSE WHEN BUTTON IS TURNED "ON"

See that the screw shaft is properly connected to the running gear and that the driving sprockets are not loose.

See that the traveler feeds on shaft properly.

See that the valve wire is held tightly to the traveler. If a reasonably firm turn of button will not bind the wire in traveler nut, the stop on button stem should be loosened and re-adjusted to where the stem will hold.

If the trouble is not in the mechanism disconnect tube from the reverse valve and examine for obstructions between lever valve and action box, also lift valve from port and apply suck tube to nipple to be sure the port under valve opens properly.

If tube is clear and valve in action box does not work, proceed about as in (b) of "ONE PRIMARY INTENSITY VALVE STAYS CLOSED."

See that the parts of running gear mesh properly.

WILL NOT REPEAT WHEN BUTTON IS TURNED ON

Apply the same tests and remedies as suggested above.

REPEAT PNEUMATIC STAYS COLLAPSED

Proceed as in "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

REVERSE PNEUMATIC STAYS COLLAPSED

See that duct from valve to action box does not leak.

Tighten the four screws in rewind cut-out pouch block.

See that reverse lever-valve properly closes its port.

If trouble is in reverse valve box proceed about as in (b) of "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

WIND MOTOR GOVERNOR

The function of the Governor is to control the tension of the suction supplied to the wind motor so that it will run at an even speed.

Suction is supplied to the governor through the tube shown at left end; it passes through the port controlled by the cone valve and into the pneumatic held open by a strong spring; from there it passes through the slot controlled by the tempo slide and through the tube to the wind motor.

The tempo slide valve is connected to and actuated by the tempo lever. With the indicator at zero the tempo slide closes the slot and prevents the passage of suction from governor pneumatic to the motor. With the slot entirely closed a small vent hole, opened to atmosphere, is uncovered by the slide valve so as to neutralize any leakage and keep the wind motor from creeping.

When the tempo slot is closed the suction supplied through the cone valve port overcomes the spring and collapses the pneumatic. As the pneumatic is collapsed the pivoted arm which is held against the movable part of the pneumatic by a spring, is raised, and the cone valve is drawn to its seat.

As the tempo lever is moved from zero the slide valve closes the atmosphere vent and gradually opens the slot, admitting suction to the motor. This weakens the suction in the pneumatic allowing the spring to pull it open and raise the cone valve from its seat. A balance is constantly maintained in this way between the suction inside the governor pneumatic and the spring outside. The amount the cone valve opens depends upon how far the tempo slot is open.

When the valve in the Universal Vent Block lifts, either from the silencer button or the running gear port, air is admitted to the pouch at the right of cone valve. The valve is lifted, and suction is turned directly into the wind motor channel; causing the motor to "speed" irrespective of the position of tempo slide.

ADJUSTMENTS

Position of Slide Valve

The slide valve should be adjusted by the leather nuts so that the wind motor is at rest when the pointer is at zero.

The motor should just begin to move when the pointer is at 10.

Tension of Regulator Spring

Tightening the spring increases the speed of the wind motor.

POSSIBLE TROUBLES

About the only trouble that might occur is leakage. This will cause the motor to run slowly. See that the screws that hold the governor together are drawn tight.

If Wind Motor creeps the tempo slide should be adjusted by means of the leather nuts provided for the purpose, to where the slot is closed and the vent open when the indicator is at zero.

REVERSE CUT-OUT

The Reverse Cut-out is to shut off the suction from the striking action when the music roll is rewinding.

When the reverse lever is moved to the rewind position a port in the running gear casting is opened; atmosphere inflates the pouch in the Universal Vent Block, lifts the valve and admits air to the tube leading to the underside of the large pouch in the Reverse Cut-out Block. The

air thus admitted inflates the pouch against the seat and stops off the supply of suction to the upper action.

When the port is closed by the reverse lever the bleed in the Universal Vent Block neutralizes the pouch and the valve is drawn down. The Cut Off pouch is neutralized and allows suction to enter the striking action.

The Universal Vent Block Valve is also controlled by the Silencer Button in key bed.

There are no adjustments on the reverse Cut-out.

POSSIBLE TROUBLES

ACTION PLAYS WHILE REWINDING

See that the port in running gear is opened by reverse lever. If port is open examine duct to Universal Vent Block for obstruction.

Attach suck tube to Vent Block to test the pouch for a leak. Blow and suck on tube to see if valve works.

See that the valve has enough play.

Remove cut off block from top of pump and see if a shaving or other foreign matter prevents the pouch from seating.

ACTION IS CUT OFF ALL THE TIME

Examine the Silencer Button to see that it is closing its port. Test the duct leading to Vent Block from Silencer Button and from running gear for a leak.

Examine duct leading from Vent Block to Cut Off pouch for leakage. See that the valve in Vent Block is not held up by dirt.

ACTION STRIKES ONE OR TWO CORDS WHEN STARTING TO REWIND

See that the valve in Universal Vent Block has enough play.

Attach suck tube to duct leading to Cut Off pouch and test for leakage through the pouch. If pouch is very porous rubberize it.

ELECTRIC SHUT-OFF

As a music roll finishes rewinding the last end uncovers the lateral groove in the take-up spool. The upper end of the spoon valve drops into the groove, causing the lower end to close the valve port.

This port is connected to primary valve box located on the back of the spool box. The valve in this primary box moves between its seats so that when the spoon valve is closed it drops down and admits atmosphere to the tube leading to the switch pneumatic valve. This valve then raises and admits suction to the switch pneumatic collapsing same and shutting off the switch.

The tube leading from the spoon valve to the primary valve has a branch which connects with a port in the spool box running gear. This port is closed by the reverse lever when it is in the "reverse" position, but open when the lever is in the "play" position.

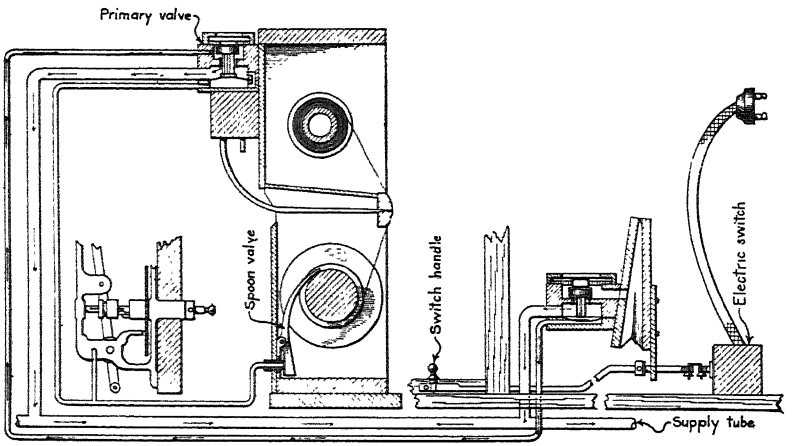


Diagram of Electric Shut-Off

When a music roll is placed in position in the spool box it may not be wound around the take-up roll enough to open the spoon valve, but when the reverse lever is moved to the "play" position the branch channel port is opened and atmosphere admitted to the primary valve, so that as soon as the electric switch is turned on the suction raises the primary valve, admitting suction to the switch pneumatic valve pouch which keeps the switch pneumatic from collapsing.

After the roll is played through the reverse lever is thrown to the "reverse" position and the port closed but as the music roll is on the take-up spool the spoon valve is held open and the switch pneumatic still stays open.

As soon as the last end of the music roll uncovers the lateral groove in the take-up spool the switch is shut off as explained above.

There are no adjustments on the electric shut-Off.

POSSIBLE TROUBLES

SWITCH WILL NOT STAY ON

Remove primary valve tube from switch action box and cover end of nipple with finger.

(a) IF SWITCH STAYS ON trouble is in primary valve or tube leading to same leaks.

Proceed about as in (a) of "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

(b) IF SWITCH STILL SHUTS OFF trouble is in valve box.

Proceed about as in (b) of "ONE PRIMARY INTENSITY VALVE STAYS OPEN."

SWITCH WILL NOT SHUT OFF

Remove primary valve tube from switch action box.

(a) IF SWITCH SHUTS OFF trouble is in the direction of the spoon valve.

Replace tube on switch box and remove tube from spoon valve where it connects with primary valve box and stop end of nipple with finger being sure that reverse lever is in "reverse" position.

(a-a) IF SWITCH SHUTS OFF there is a leak in tube to spoon valve or the branch to the spool box running gear; or the valve in the running gear leaks.

(b-b) IF SWITCH STILL STAYS ON trouble is in primary valve or tube from same to switch valve box is clogged.

See that primary valve works properly.
See that bleed in primary valve is clean.
This bleed is readily accessible by removing small U-shaped tube at back of primary valve box. Bleed is in end of bent nipple.

(b) IF SWITCH STILL DOES NOT SHUT OFF trouble is in switch valve box.

Proceed about as in (b) of "ONE PRIMARY EXPRESSION VALVE STAYS CLOSED."

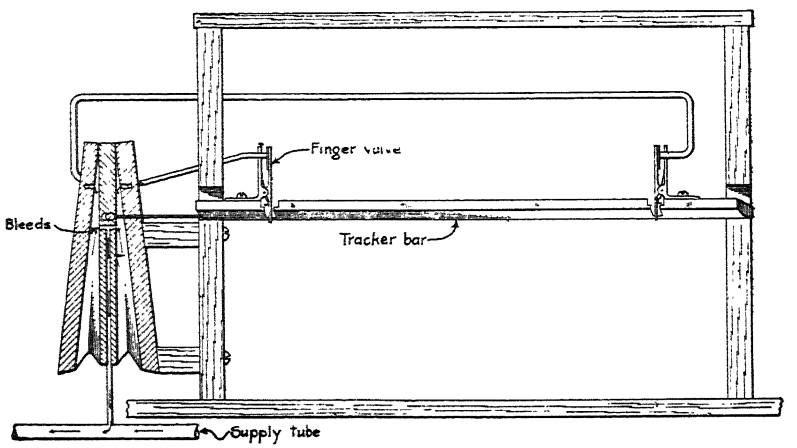


Diagram of Automatic Tracking Device

AUTOMATIC TRACKING DEVICE

The Automatic Tracking Device is to keep the perforations in music roll in alignment with the holes in tracker bar.

This mechanism is controlled by two small levers, or fingers, set into the tracker bar, one at the right end and one at the left. The distance between these fingers is the exact width of a normal music roll. The space between the finger and the first hole in tracker bar at either end corresponds exactly with the distance from the first perforation to the edge of the note sheet.

Each finger is held by a light spring against a port which leads to one side of the double pneumatic. The right finger is connected to left half of pneumatic. The left finger is connected to the right half.

Each side of the double pneumatic is constantly supplied with suction through its own bleed. Both bleeds connect with the supply tube.

The tracker bar, or in some cases the upper spool, is shifted by the movable board of the double pneumatic.

When a music roll of the normal width is exactly central on the tracker bar the edges just touch the fingers but do not open either of the valves. The equal tension of the suction in both sides of the double pneumatic holds the movable board in its central position.

If the music roll shifts to one side its edge will open one of the finger valves and spill some of the air being fed to its corresponding pneumatic, thereby weakening its pull on the movable board and allowing the other pneumatic to collapse somewhat, thereby shifting the music roll until the edge ceases to open the finger valve and thus brings the double pneumatic back into balance.

If the music roll is slightly narrow on account of shrinkage of the paper, the roll will have a little play between the fingers but it cannot shift far before one of its edges engages a finger valve and brings it practically central again.

If the music roll is slightly wider than normal on account of swelling of the paper both valves will be held open a little, thereby spilling a small

amount of air out of each pneumatic. If the roll shifts out of center more air will be spilled from one pneumatic than the other, thereby allowing the other pneumatic to re-adjust the tracker so that the roll resumes its central position.

ADJUSTMENTS

The Automatic Tracking Device almost never needs adjustment.

The ears can be adjusted by loosening screws in the back.

Great care must be used in adjusting this device.

On the grands the front tracker panel has to be removed before screw-driver can be used on the screws.

On the upright a medium short screw-driver is necessary to reach in from the back.

The distance between the ears should be 11¼" and both ears should be exactly the same distance from the end holes in the tracker.

POSSIBLE TROUBLES

This Tracking Device is so extremely simple in its construction and operation that little trouble excepting leakage can occur.

Leakage in double pneumatic would prevent its operation. This can be tested by closing both ducts to finger valves where they enter the pneumatic and applying suck tube to supply nipple.

A leak in either tube leading from pneumatic to control ports would draw tracker bar out of alignment. Test this by disconnecting tube from pneumatic, attaching suck tube, and sucking.

Leakage must be located and repaired.

See that fingers operate freely and close their ports.

See "RE-WIND OPERATES IN MIDDLE OF PIECE," under the heading, "Automatic Re-Wind Mechanism."

LOUD PEDAL

The Loud Pedal mechanism is controlled from the third hole in bass end of tracker bar (3B). When a perforation in the note sheet registers with this hole, air enters the duct, passes through the sieve which prevents dust from accumulating in the tube, then through the cut-out switch to the Loud Pedal action box located in lower right hand portion of piano case. The cut-out switch stops off the passage of air through the duct when at "off" and renders the pedal inoperative from tracker bar.

When 3B is open, atmosphere is supplied under the pouch in larger quantity than the bleed can withdraw it, with the result that suction draws the pouch up and lifts the valve, this causes the pneumatic to collapse and lift the pedal dowel. When 3B is closed the bleed neutralizes the pouch, the valve is sucked to its lower seat, and the pneumatic returns to its normal position.

ADJUSTMENTS

Between Riser Dowel and Extensin Hook

When the mechanism is installed in the piano the pin in the riser dowel is placed so that it is in perfect adjustment with the extension hook of the pneumatic, and it practically never gets out of adjustment.

Between Riser Dowel and Piano Action

There should be a very slight up and down play in the riser dowel which can be regulated by felt washers on the upper end of dowel.

Motion of Dampers

The flat dampers in the middle of the piano should lift away from the strings about ⅛" but no more. This motion will allow the V shaped dampers to clear the strings.

The screw in the movable board of the pneumatic is for adjusting the throw of the pneumatic which controls the distance the dampers lift from the strings.

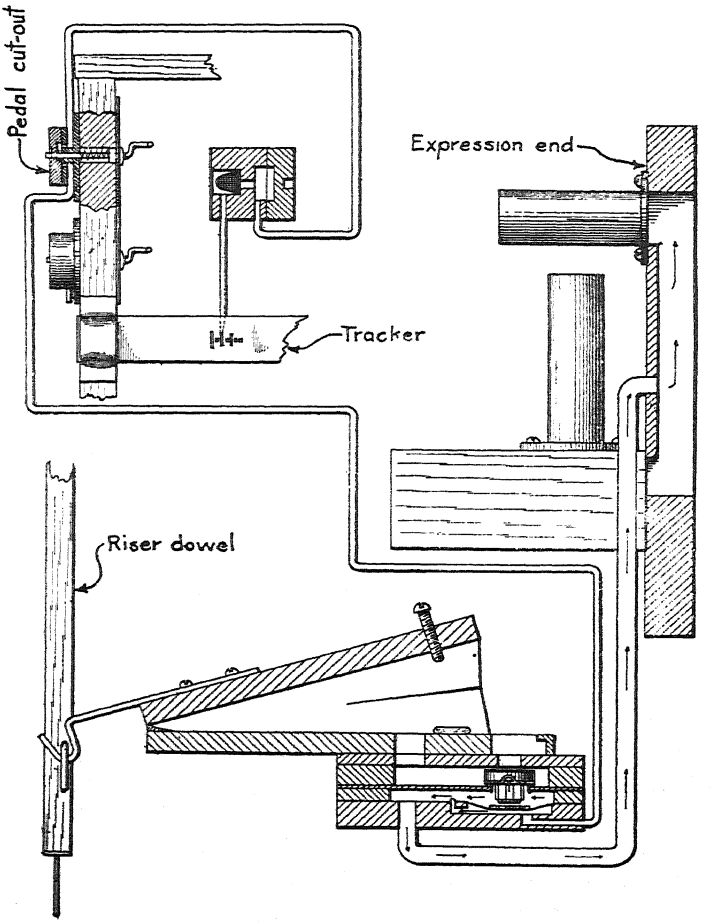


Diagram of Loud Pedal Mechanism

POSSIBLE TROUBLES

PEDAL PNEUMATIC DOES NOT COLLAPSE when 3B hole in tracker is open.

See that the Loud Pedal switch is "on."
Disconnect tracker tube at Loud Pedal action box.

(a) IF PEDAL PNEUMATIC THEN COLLAPSES the trouble is in the tube.

Proceed about as in (a) of "ONE PRIMARY INTENSITY VALVE STAYS CLOSED."

(b) IF PEDAL STILL DOES NOT COLLAPSE the trouble is in the pedal mechanism.

Proceed about as in (b) of "ONE PRIMARY INTENSITY VALVE STAYS CLOSED."

In case the action box is of double valve construction, dampness may cause the primary valve to have too little motion, or cause it to stick.

See that there is no dirt on valve seats.

See that packed joints in action box do not leak. Tighten all screws.

A leak in the pedal pneumatic will keep it from working.

PEDAL PNEUMATIC STAYS COLLAPSED when 3B hole in tracker is closed.

Disconnect tracker tube at Loud Pedal action box and cover end of nipple with finger.

(a) IF PEDAL PNEUMATIC OPENS the trouble is in the tube.

See that valve on Loud Pedal button closes properly and does not leak.

Proceed about as in (a) of "ONE INTENSITY VALVE STAYS OPEN."

(b) IF PEDAL PNEUMATIC STILL STAYS COLLAPSED the trouble is in the pedal mechanism.

Proceed about as in (b) of "ONE INTENSITY VALVE STAYS OPEN."

PEDAL MECHANISM WORKS BUT DAMPERS DO NOT RAISE

See that pedal riser dowel is not disconnected from pneumatic or out of position at top.

See that there is no lost motion where pneumatic is connected to dowel.

DAMPERS STAY OFF OF STRINGS when pedal pneumatic is inoperative.

See that the pneumatic is not adjusted too close on the riser dowel.

See that all mechanical connections are in correct position.

See that loud pedal mechanism of piano works freely.

SOFT PEDAL

The Soft Pedal mechanism is controlled from the third hole in the treble end of the tracker bar (3T). The duct passes through the "Automatic Expression Cut-out" which is described in another section, and from thence to the soft pedal mechanism which is located in the lower eft hand corner of the piano.

Its operation is the same as the loud pedal.

ADJUSTMENTS

Between Riser Dowel and Piano Action

There should be a very slight up and down play in the riser dowel which can be regulated by felt washers on upper end of dowel.

Motion of Hammers

The hammers should move about half way up on the grands and 7/8" from the strings on the uprights.

The adjustment in the uprights is made by the thickness of the felt stop on the hammer rail.

On the grands the full travel of the pneumatic with no lost motion is just enough.

POSSIBLE TROUBLES

See that the Automatic Expression switch in the spool box is in the "on" position and proceed the same as in the "Loud Pedal."

THE PUMP

The large driving wheel is belted to the pulley of the electric motor which furnishes the motive power. The main shaft is offset to form a crank. Actuated by the crank is a disc with four connecting rods extending to each of the four feeders.

When the crank is rotated the feeders are successively closed and opened. In opening a feeder bellows the valve on the outside (opening outward) is closed by the partial vacuum developed inside the feeder. This suction also opens the valve (opening inward) between the windchest and the feeder allowing air to be withdrawn from the reservoir. When the feeder is fully extended it has done its work and starts to close; with this change of direction the positions of the valves are reversed. Suction in the reservoir draws the inside valve shut, and the air inside the feeder forces the outside valve open.

The four feeders are connected by means of the chest board, which forms the back of the pump, to a common reservoir. As air is withdrawn from the reservoir the suction produced causes the movable parts of the reservoir to collapse. Springs inside of the reservoir oppose the collapsing member and their resistance determines the strength or degree of the suction maintained within the reservoir. As the reservoir is collapsed by the suction the tension of the air raises in proportion to the increased

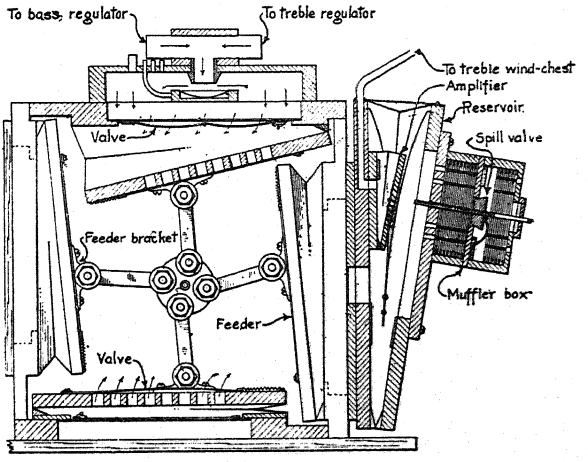


Diagram of Pump

pressure of the springs. As the stem of the spill valve, which is located inside the muffler box, comes in contact with the amplifier (described later), the spill valve is raised off its seat, thereby preventing the tension of the air from rising further

THE AMPLIFIER

The amplifier is a small bellows located inside the reservoir and connected to the treble windchest by means of a tube. When the tension in the treble windchest is low the tension within the amplifier is likewise low and the greater tension in the reservoir keeps the amplifier bellows distended with force enough to resist the pressure of the spill valve stem when it comes in contact with it. Therefore the spill valve opens. But as the tension in the treble windchest rises, the difference between the tension in the reservoir and that in the amplifier becomes less and the power of the amplifier to resist the pressure of the spill valve becomes less until it reaches a point where it collapses. The reservoir then must close to a point where the spill valve stem meets the resistance of the collapsed amplifier bellows. As the reservoir is closed further than normal the tension is raised proportionately above normal.

The normal reservoir tension is 20″ water pressure. When the treble windchest reaches a tension of 15″, or a little above No. 5 intensity, the amplifier collapses, raising the pumping tension to about 28″. It will readily be seen that the pump normally operates at 20″ tension, but when a loud passage in the music comes the tension in the reservoir automatically jumps to a higher level. This makes it unnecessary to keep the pump and other mechanisms constantly under high tension thereby subjecting them to constant strain.

ADJUSTMENTS

Spill Valve

The Spill Valve is adjusted to give 20″ water pressure at the factory and should under no circumstances be changed.

Belt

Slack can be taken out of belt by moving the motor which is mounted on an adjustable base.

Do not get the belt too tight or it will put undue strain on pump and motor bearings.

POSSIBLE TROUBLES

PUMP DOES NOT EXHAUST ENOUGH AIR to play loudly in loud passages.

Usually caused by belt slipping.

Slack can be taken out of belt by moving the motor which is mounted on an adjustable base.

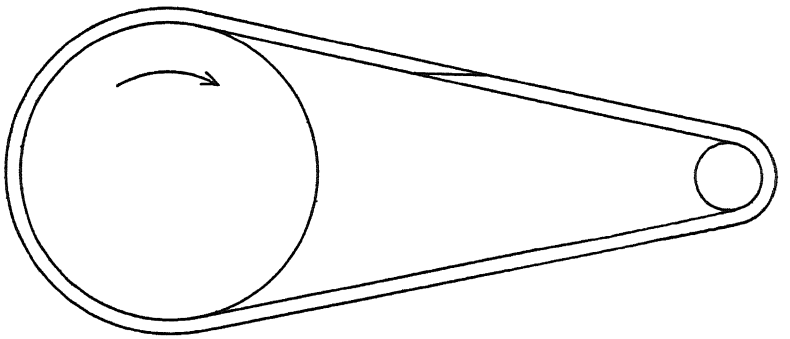
Do not get the belt too tight or it will put undue strain on pump and motor bearings.

See that all screws in packed joints are drawn up tight.

Tests for leaks throughout player.

BELT TROUBLES

If a belt is put on the wrong way the splice may start to open. See illustration below, which shows the way the splice should slant when belt is put on correctly.



SLIGHT METALLIC CLICK at regular intervals.

May be caused by metal end of inside valve striking the valve seat.

Before removing pump take a listening tube and determine in which feeder the noise seems to be. Mark the feeder.

Remove pump from case by disconnecting all tubes, loosening static wire, and unscrewing butterfly nuts at either end. Pump can now be lifted out.

Remove panel board from outside of the feeder where noise has been located.

Take screws out of aluminum valve, lift valve out and examine it, tapping it smartly with the finger tips. The clicking noise will probably be recognized; it can be eliminated by shellacing thin felt or tape to the aluminum plate where the metal clip on spring end of valve comes in contact with it.

PRONOUNCED POUNDING OR CLICKING at regular intervals.

A loose feeder bracket would cause a regular pounding noise if quite loose; if only slightly loose will cause a click or squeak.

See that the screws in all these brackets are drawn tight.

May be caused by loose bearing.

Lay the pump, wheel down, on the floor, holding it solidly with the knees, and try each bearing for possible lost motion. Grasp the center disc firmly and test it for lost motion. Turn the wheel to various positions and test every bearing again.

When the loose bearing is located the cone should be adjusted to where the bearing works freely but without lost motion.

SHARP INTERMITTENT CLICKING OR GRINDING noise in pump.

May be caused by a broken ball in bearings.

Remove pump from case, take off round muffler board at back and examine all bearings.

A bearing with a broken ball can sometimes be distinguished by the grease around it being black, as if mixed with graphite.

If discolored grease does not indicate where the broken ball is, perhaps the easiest way is to lay pump with wheel down, mark the thick chest board so it can be put back just as it came off, take out the screws, and lift chest board away from feeders. Next remove screws from metal feeder brackets; take off lock nut and cone from bearing in center of disc and lift out the entire spider. Each bearing is now easily accessible for examination.

Take off lock nut, washer, and cone, and inspect the balls. Examine each ball minutely, as a ball will sometimes split in the middle and the two halves will be held together by grease.

If a broken ball is found examine the others for possible scaling. Any ball with surface checked should be replaced with a new one. If bearing surface of cone or ball race is scored replace with new cone.

ELECTRIC MOTORS

The motors used in the Ampicos are of special construction and are rated at one-twelfth horse power.

BE SURE THE MOTOR IS OF THE PROPER CURRENT AND VOLTAGE

The current supplied by generating plants throughout the country varies in kind, in voltage, and in frequency of alternations. Often in one city direct current is delivered to one part and alternating current to another; this should constantly be borne in mind and when an instrument is sold find out from the electric company exactly what current is supplied to the place where it is to be delivered.

Motors adapted to the local requirements can be obtained from the manufacturers of the Ampico.

Direct current motors will not run if connected to lines delivering alternating current, nor will alternating current motors operate under direct current. A motor connected to a current not adapted to it will not start and will generally "blow" the fuse. If fuse does not "blow" and the current is not immediately shut off the motor itself will be burned out and ruined.

The wire connecting the pump frame and motor casing is for the purpose of dissipating a small amount of static electricity generated by the pump. If it is disconnected for any purpose it should always be replaced. Without this wire the charge generated by the pump will sometimes jump to the piano plate or other metal object, causing a slight snapping noise.

ADJUSTMENTS

Alternating Current Motor

There are no adjustments on this type of motor.

Direct Current Motor

The pressure of the brushes against the commutator can be

adjusted by loosening the set screws that hold the plugs back of the brushes.

The spring should not be touched unless there is a bad squeaking in the brushes which cannot be got rid of any other way than by loosening the pressure of the brushes.

Do not get the spring so weak that the brushes spark.

POSSIBLE TROUBLES

Practically no troubles develop with the electric motors.

NOISE

A continuous clicking noise while motor is running is sometimes caused by pulley being loose on shaft. This condition cannot be detected by trying the pulley with the hand.

Tighten the set screws very firmly with a well fitting screw driver.

The commutator of direct current motors may become corroded and noisy after long use.

It may be cleaned by applying very fine white sand paper while motor is running. (Never use emery cloth.)

Motor brushes sometimes squeak.

Clean commutator thoroughly with a cloth and a little vaseline. See that brushes are not held too tightly against commutator. Be careful not to adjust the spring so loose that the motor sparks.

In changing motors be careful that the motor is held away from case of piano by layers of felt; this felt absorbs vibrations which otherwise would be transmitted to the piano.

Alternating current motors generally make a slight noise when starting and stopping. Because of their construction this noise is unavoidable.

LUBRICATION

The oil cups should be examined during inspection to see that the bearings are properly lubricated.

Use vaseline in the retainers and best grade motor oil in the cups.

In replacing oil cups be sure that the wicks come in contact with the rotating shaft.

INSPECTION OF THE AMPICO

A special Inspection Roll has been made for quick and acc urate in spection of an Ampico. After the tempo is correctly set the complete inspection of the working parts of the Ampico up to the note test is to be made with the roll running at tempo 60, excepting the No. 1 intensity test.

The various mechanisms of the Ampico are operated by the Inspection Roll in such a way that the expert repairman can shift his attention from one mechanism to another as fast as the roll moves along and thereby have his inspection nearly completed by the time the roll has run through, providing everything works properly.

After the Inspection Roll is run through a regular Ampico roll is played to test the expression buttons and the repeat device.

This completes the inspection test.

In the first part of this book full directions for locating troubles and repairing same are given, also directions for making adjustments.

The order of the Inspection Test is as follows:

1. Spool Box Running Gear.
2. Cleaning Tracker Ducts.
3. Electric Motor and Pump.
4. Automatic Tracker.
5. Tempo.
6. Crescendo Bass.
7. Crescendo Treble.
8. Intensity Valves Treble.
9. Intensity Valves Bass.
10. No. 1 Intensity.
11. Amplifier.
12. Soft Pedal.
13. Loud Pedal.
14. Modifying Device.
15. Automatic Expression Cut-Out.
16. Notes.
17. Re-wind.
18. Electric Shut-Off.
19. Expression Buttons.
20. Repeat Device.

INSPECTION TEST

Do not put Test Roll in piano until after you have finished inspecting the running gear and cleaned tracker ducts.

Spool Box Running Gear

Oil all bearings of running gear.

Wipe off the running gear with a rag, being sure to remove all excess oil.

Never leave the running gear looking dirty or greasy.

See that chains are not too slack, nor too tight.

See that all running parts work freely.

See that reverse lever works properly.

Cleaning Tracker Ducts

Pump out the tracker very thoroughly.

Be sure your tracker pump works well. If it leaks the piston leather may need cleaning and oiling. The piston leather should be oiled so it will keep very soft and pliable.

Sometimes when the player is very dirty, the tracker pump or the suck tube will draw little wads of dirt up to the mouth of the tracker. These should be removed with a pin.

Never fail to give a player a thorough pumping out when you inspect it.

Electric Motor and Pump

Place Inspection Roll in piano and wind tightly on take-up spool until the word "Stop" comes over tracker. Set tempo at Zero; automatic expression "On;" loud pedal "On;" modifying lever at "Normal," soft pedal lever at highest point. (This lever has only been put into some uprights and is located at the left end of the key slip.) See that both the knobs in repeat mechanism are loose. Throw re-wind lever to "Play" position and turn on electric switch.

If the motor does not start or the electric switch shuts off it is obvious that the trouble must be located and fixed before the test can proceed.

Move tempo lever forward a little and run roll ahead until "Electric Motor and Pump" comes over tracker.

Listen for noise in electric motor or pump.

See if motor brushes spark (direct current motors only).

See if belt is slipping.

Remove cover from muffler box.

See if pump is supplying (there should be steady spill).

See that oil cups contain oil if provided with wicks or vaseline if grease retainers are used.

Automatic Tracker

Move tempo lever forward a little and run roll ahead until "Automatic Tracker" test perforations are over tracker bar. Stop roll at this point and see if perforations register with tracker holes.

Tempo

Set tempo at 60 and hold roll with hand so that the perforations of the first tempo test chord are about 1/8" from the holes in the tracker bar. As the second hand of your watch reaches a ten second point release the roll. It should require ten seconds to reach the single note and twenty seconds to reach the chord following.

Crescendo

(***Bass End***)

Remove the Amplifier tube and plug end of same.

Be sure the tempo is correct at 60 before beginning this test. After the second tempo test chord is struck a single note in the bass is sounded at exactly the moment the bass crescendo pneumatic is supposed to start to collapse on a slow crescendo.

This pneumatic should become fully collapsed ***after*** the next chord of two notes in the bass is struck, but ***before*** the following chord of four notes. If it reaches its full collapse between these two chords the timing is correct. If it becomes fully collapsed before the chord of two notes is played it is too fast. If it is not fully collapsed by the time the second chord is played it is too slow.

As a different single note in the bass is struck, the slow decrescendo begins.

If the pneumatic reaches its normal position after the next chord of

two notes is struck but before the following chord of four notes, the timing is correct.

If it reaches its normal position before the chord of two notes is struck it opens too fast.

If it does not reach its normal position until after the chord of four notes is struck it opens too slowly.

Another single note is struck as the fast crescendo begins and a chord of two notes further along to show if it is too fast while a chord of four notes is struck to show if it is too slow.

A different single note indicates the beginning of the fast decrescendo test which is similar to the fast crescendo.

The fast crescendo only takes about two seconds to operate so it must be watched very closely to see that the timing is correct.

(*Treble End*)

One note in the treble will strike as the slow crescendo begins, etc. Test is the same as bass crescendo.

Replace amplifier tube.

Intensity Valves

(*Treble End*)

In this test the secondary valves should be watched in the upright or felt with the finger in the grands. The finger should be touched lightly to the side of the No. 1 valve first and when a note in the treble strikes once the valve will rise and drop quickly three times to show the valve works properly when the cancel valve is on. It will then rise and stay up for a short period of time, then drop, then rise again, and stay up for the same period before it drops. This second test shows that the valves lock open. The action of the valve in this test might be represented by three short dashes and two long ones, thus: — — — ——— ———

As soon as the valves drop after the second long rise, move the finger to the No. 2 valve and when the note in the treble strikes twice it will signal that the No. 2 valve should rise and fall three times quickly and twice slowly. Likewise when the note strikes three times the No. 3 valve is tested.

(*Bass End*)

Same test as on Treble end.

No. 1 Intensity

Move tempo to 80.

The first part of the piece played should sound *soft*. The last half is played with the soft pedal on and should sound *very soft*.

There should be no difference in the loudness of the bass and treble.

Be *very sure* that the treble does not sound softer than the bass.

The No. 1 intensity is set correctly at the factory and very seldom needs adjustment. The best way to adjust it is with a gauge.

Amplifier

Move tempo back to 60.

As a chord strikes softly on the bass side the Amplifier test begins. Just as a chord in the treble strikes loudly the reservoir should close slightly, showing that the Amplifier has worked and the pumping pressure gone up. Again the bass chord is struck at the time the reservoir should open up to its normal position. Three times this is repeated.

Sometimes the owner of a piano does not wish the Amplifier to operate as it makes the loud passages too loud to suit his taste. In such cases merely leave the Amplifier tube disconnected from the reservoir and stop up the end of the rubber tube. Leave the reservoir duct open.

Soft Pedal

A chord in the treble strikes just as the test begins.

The hammers move toward the strings and stay there a moment so the distance of travel can be noted. They should move up at least half way on the grands and about 7/8" from the strings on the uprights. Next the hammers move forward and back rapidly six times.

The soft pedal should not move too fast nor too slowly. The perforations in the test roll are of such length as to just give the hammers time to move all the way forward before they start back, and the spaces between the perforations are of a length which gives them time to get back to their normal position before they start forward again.

If the pedal works too fast the hammers will move very quickly and wait at the end of each movement.

If the pedal works too slowly the hammers will be unable to complete their travel in one direction before they start to move in the other.

If the pedal works properly the hammers will move the full distance forward and back with practically no hesitation at either end of stroke.

A very slight error in adjustment does no harm but the soft pedal should not be so slow that it does not get to the end of the stroke each way; nor should it be so fast as to be jumpy.

Loud Pedal

As a chord in the bass strikes the test begins.

The dampers are raised and held off the strings long enough to see that the motion is correct.

The flat faced dampers in the middle of the piano should lift about 1/8" from the strings but no more. The dampers are then lifted and dropped back six times to show the speed of movement. They should work snappy. They must not be sluggish in coming back to the strings.

Modifying Device

Softening Device (Bass End)

A chord is struck loudly in the bass. Immediately move the modifying lever to the "Soft" side. The chord strikes again and it should sound much softer. Move lever back to "Normal." The chord strikes again but should sound loud.

This part of the test shows that the softening device is working.

A chord is now struck softly in the bass. Move lever to "soft." When chord is struck again it should not sound any softer.

Move lever back to "Normal" and when chord strikes again it should sound no louder than the preceding chord.

This shows that the little spring on the re-regulator valve stem is not adjusted too weak.

A chord is now struck medium loud in the bass. Move the lever to "Soft." When the chord strikes again it should sound a little softer. Move the lever back to "Normal" and when chord strikes again it should sound a little louder than the preceding chord.

This shows that the little spring on the re-regulator valve stem is not adjusted too strong.

(Treble End)

Same test as Bass end.

Loudening Device (Bass End)

A chord is struck softly in bass. Immediately move modifying lever to "Loud" side. When chord is struck again it should sound loud. Move lever back to normal and when chord strikes again it should sound soft.

(Treble End)

Same test as Bass end.

Automatic Expression Cut-Out

Just after a chord in the middle of the piano is struck loudly, move the automatic expression switch to the "Off" position.

A chord is then struck in the bass, followed by one in the treble. These chords should sound soft if the automatic expression cut-out is working correctly. The intensity setting for the chords is loud but with the switch in the "Off" position the intensity valves will all be shut off and both chords should sound soft.

After the chord in the treble is struck turn your attention to the hammers. As a single note is struck in the bass the soft pedal perforation comes in the test roll, but the soft pedal *should not work,* which shows that it cuts off.

Next a single note in the treble is struck as the re-wind perforation comes in the test roll, but the re-wind *should not operate* which shows that it cuts off.

Notes

Move automatic expression switch to "On" position and set tempo to 80.

The notes should all repeat equally well.

If a note fails to work properly, stop the roll with the long perforation over the tracker and shut off the electric switch.

Pump this note out thoroughly and then suck and blow vigorously with the suck tube.

Turn on the switch and cover and uncover the perforation with the finger. If the note fails to respond apply the suck tube with switch "On."

Sometimes the pump or suck tube will draw a little wad of dirt up into the brass tube at the back f the tracker. It can usually be freed with a piece of wire

Care must be used in sticking the wire into the tracker that it is not pushed through the rubber tube at the back.

Most trouble with notes is caused by dirt in tracker duct or bleed.

Sometimes it is necessary to adjust for lost motion also the let-off of pneumatics.

Re-Wind

A chord in the middle of the piano strikes just before the re-wind perforation is reached. The roll should re-wind as the perforation reaches the tracker.

If the roll does not re-wind locate the trouble and fix it.

If the notes play during the re-wind find the trouble in the re-wind cut-out and fix it.

Electric Shut-Off

The electric switch should shut off when the roll is re-wound.

Expression Buttons

Put a large Ampico Roll into the piano with the Automatic Expression switch "Off."

The buttons should work freely.

The loudness of the playing should gradually increase as the buttons are gradually depressed.

The loudest that can be obtained with the buttons is not quite as loud as an Ampico Roll produces with the Automatic Expression "On."

Repeat Device

Start at the beginning of the Roll and allow about a foot of the music to pass over the tracker bar, then tighten the "Repeat" knob.

Play the piece through with the Automatic Expression "On," letting it rewind automatically. This will test the repeat on a long roll.

Loosen the "Repeat" knob and after the roll has gone ahead a little, tighten the "Repeat" knob again.

Let the roll proceed about ten feet and tighten the "Re-wind" knob The roll should immediately re-wind and start ahead again when it reaches the point where the "Repeat" knob was tightened.

Loosen both knobs before taking roll out of player.

The AMPICO
Reproducing Piano

INSPECTORS'
INSTRUCTION BOOK
1920 SUPPLEMENT

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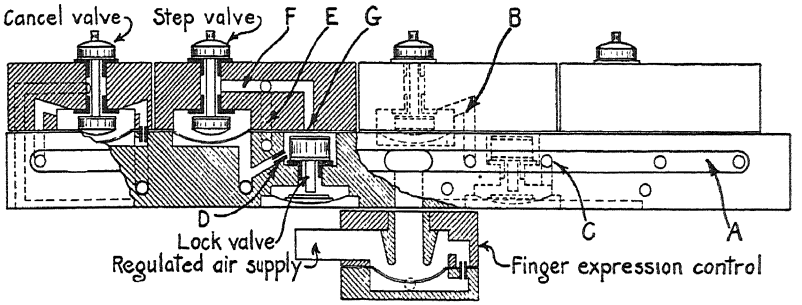


Diagram of Valves "1920" Step Mechanism

THE 1920 AMPICO EXPRESSION UNIT

The "1920" Ampico Expression unit is what is termed a "single valve" mechanism while most of the "1919" Expression units and all types preceding it, were "double valve." It has been found that the single valve operates somewhat more quietly than the double valve.

Another improvement is the construction of the valves which are made in unit form so that any valve unit with its lock valve can be removed without disturbing the others.

A further improvement is the placing of the spring pneumatic under the regulating valve instead of above the lever arm.

The crescendo mechanism is connected to the step mechanism by means of rubber tubes only and is somewhat changed in design. The crescendo mechanism is made in only one form and is exactly the same in the treble and the bass also in the grand and upright types. The step mechanism is made treble and bass but is the same for grands or uprights with the exception of the main tube connections. The only part of the step mechanism which is not the same in the treble and bass sides is the valve block.

The finger expression control in the "1920" model does not operate upon the valve stem as before but is entirely pneumatic and controls the tension of the supply to the expression valves.

How the Step Mechanism Works

The main wind-way (A) is under the rubber cloth sealing strip on the front of the valve board and is connected to regulated supply in the valve block through the finger control mechanism which is on the underside of the valve board. The step valves and lock valves also the cancel valve get their supply of regulated air through channels connecting with the main wind-way.

The step valve supply channel (B) runs from the valve board into the unit through the front hole of the two middle holes in the unit. This channel can easily be traced with the unit removed. The supply to the lock valve (C) runs directly from the main wind way to the upper side of the lock valve pouch. The supply to the cancel valve is through the front hole in the cancel valve unit similar to the step valve unit.

The step valve bleed (D) is located in the lock valve chamber and can easily be seen and cleaned when the unit is removed. The cancel valve bleed is likewise accessible when the cancel valve unit is removed.

The channel (E) which is the back one of the two middle holes in the step valve unit is a branch of the channel (F) and connects the step valve with the intensity pneumatic. The channel (F) runs from the step valve to the upper side of the lock valve and supplies atmosphere to the bleed (D) when the step valve opens thereby locking itself open. When the lock valve raises it shuts off this channel by closing the right hand hole (G) in the step valve unit and admits regulated air from its under side through the bleed to the pouch chamber of the step valve which causes it to close instantly and stay closed after the lock valve returns to its lower seat because regulated air is now supplied to the pouch chamber through the channel F and the lower end of the step valve, which is in its individual regulated air chamber.

The lock valves can be removed when the units are taken off and are therefore very accessible. The pouch of the lock valve is under the rubber sealing strip on the lower side of the valve block and the three lock valve pouch chambers are connected to the cancel valve by means of a groove which is also under this sealing strip. When the cancel valve unit is removed the hole which connects the valve to this groove can be seen at the left side.

THE CRESCENDO MECHANISM

The principle of operation is the same as the "1919" model. The pouches are in the upper board of the pneumatic and the valves in the board above. There are no adjustments for the slow or fast crescendos. The constriction for the slow crescendo is in the left elbow in the valve board and can be seen by removing the rubber tube connecting with the

pneumatic. The fast crescendo constriction is located in the slow crescendo valve chamber which is the one on the right side of the supply tube and having the muffler tube.

The pallet valve can be removed for cleaning by holding the pneumatic closed with the hand. The spring should first be lifted from the slot and moved to the side.

THE FINGER EXPRESSION CONTROL

As can be seen in the section of this device there is a simple diaphragm which shuts off the supply of regulated air to the step valves when raised. It is equipped with a bleed somewhat larger than the ordinary primary pouch bleed. The finger button is very similar to the old type excepting that it merely admits atmosphere in increasing quantity as it is gradually depressed.

This gradually overcomes the effect of the bleed and in turn gradually moves the diaphragm up and shuts off the supply of regulated air as before mentioned.

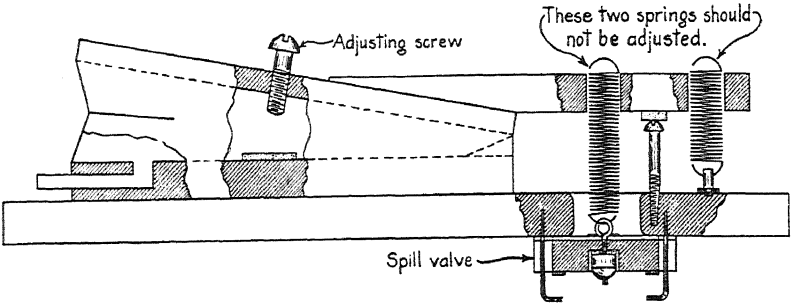
Lowering the tension of the regulated air reduces the down pull of the intensity pneumatics on the regulating valve and therefore lets more air through which causes the action power pneumatics to play louder. The finger control does not work well with the "Automatic Expression" switch on.

MODIFYING DEVICE

When the modifying switch is in the "Subdued" position two ports which connect to the treble and bass re-regulator valve unit are opened. This throws re-regulated air into the re-regulator pneumatics which operate the same as in the 1919 model. The re-regulator valve unit is located on the expression unit valve block just above the re-regulator pneumatic and is connected to same by a short rubber tube.

When the modifying switch is in the "Medium" position, the re-regulator is inactive and the Amplifier is inactive so that the playing is the same as "normal" in the 1919 type excepting that the ampllifier is cut out.

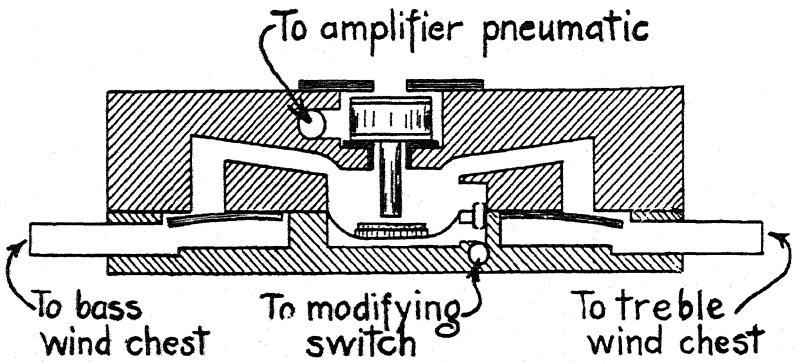
When the modfying switch is in the "Brilliant" position, the Amplifier is active and the playing is the same as "Normal" in the 1919 type.



Amplifier

THE AMPLIFIER

The principle of the Amplifier is somewhat different from the 1919 type. In the old one the position of the spill valve stop was changed when the amplifier became active. In the new one the tension on the spill valve spring is increased. The adjusting screw on the movable board of the pneumatic limits the motion. If this adjusting screw is all the way in the pneumatic cannot collapse and therefore there will be no amplifi-



Amplifier Control Valve

cation. If it is backed out the amount of amplification will be increased. The range is from 20″ to any point up to about 35″.

The tube which is opened by throwing the modifying switch to the "Brilliant" position goes to the amplifier control valve which contains two connections one from the treble wind chest and one from the bass; each being equipped with a check valve to prevent any flow of air from treble to bass or vice versa when the pressure is different on the two sides. By examining the drawing of the valve it can readily be seen how it operates.

The Amplifier has only one adjustment and neither of the springs should be touched as they are set correctly in the factory. Like the old type it normally spills at 20″ and begins to amplify at about 15″ or between No. 5 and No. 6 intensities.

REPEAT MECHANISM

The repeat mechanism consists of a simple three way switch which when in the "off" position connects the hole in the take-up spool in the grands, or the spoon valve in the uprights, with the electric switch valve. When the switch is in the "On" position the hole in the spool is connected with the replay pneumatic which throws the reverse lever into the "go ahead" position when a roll is rewound thereby causing it to play through again. If the repeat switch is "off" the electric switch is shut off when the roll is rewound.

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